PAGE'S WEEKLY.—January 13, 1905. This Paper Copy for Circulation Abroad.

SIXPENCE.
(Registered as a Newspaper.)

FRIDAY,
JANUARY 13, 1905.

No. 18. Vol. 6.

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AN 14 1905

PAGE'S WEEKLY

ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

France, Paris : 22, Rue de la Banque.
Germany, Berlin : 13, Unter den Linden.
Russia, St. Petersburg : 14, Nevsky Prospect.
Italy, Rome : 307 Corso.
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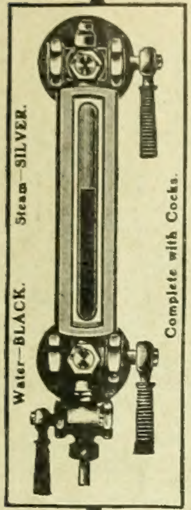
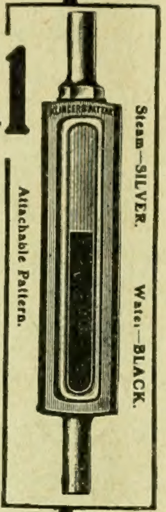

Water—BLACK. Steam—SILVER.
Complete with Cocks.


Attachable Pattern.
Steam—SILVER. Water—BLACK.

A Common Glass Tube
Water Gauge may be the Death of You
or Your Workmen. At least, it is pretty sure to injure someone, if it gets a chance.

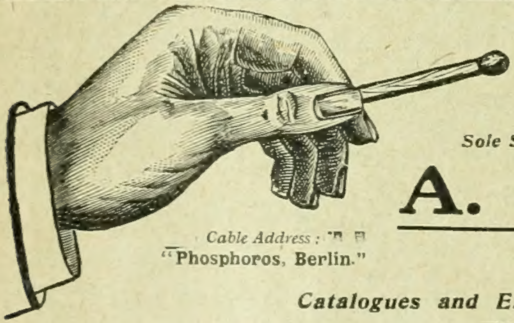
Keep Out of Hospital

and keep your Men out, too, by fitting up the *Only Safe Gauges* ever made. They are known as the **"Klinger" Water Gauges,** and they Won't Burst, have No Glass Tubes to break, require No Protector, and you can See the Water Level at a Glance, and at a considerable distance.

If you Value your Life, *don't work your Boiler with a common glass tube water gauge, but send for our Pamphlet* "K.A."

Engineers and
Contractors to
the Admiralty.

Richard Klinger & Co.
66, FENCHURCH STREET, LONDON, E.C.



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A. ROLLER, Engineer,

BERLIN N.20, GERMANY.

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Catalogues and Estimates for Complete Plants Free on Application.

REFERENCES TO MATCH MANUFACTURERS ALL OVER THE WORLD.

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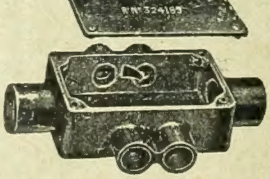
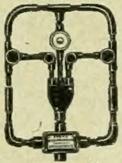
STEEL
CONDUIT
Co., Ltd.,**

SIMPLEX FOR INTERIOR **CONDUITS** ELECTRIC WIRING.





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Abridged List
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The SIMPLEX STEEL CONDUIT SYSTEM is the most complete system made. It consists of 10 grades of conduits, and nearly 1,000 standardized fittings.

Awarded Gold Medal, International Fire Exhibition, London, 1903.

of 80, DIGBETH, BIRMINGHAM,
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LIVERPOOL, & GLASGOW.

General Manager's Office:—
WESTINGHOUSE BLDG., STRAND, W.C.

PAGE'S WEEKLY Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water Works and Industrial Undertakings,

97, QUEEN VICTORIA ST., LONDON, E.C.

Telephone No.: 5754 Bank. Write for particulars.

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Enormous Profits Easily Made.

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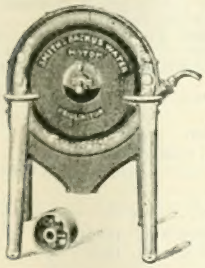
PATENT WATER-TUBE BOILERS.

These Boilers are in use throughout the world to the extent of 4,700,000 h.p., generating steam for all purposes, and fired with all kinds of fuel.

See our Advertisement appearing January 20th, page 45.

HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.
WORKS—Renfrew, SCOTLAND.



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Backus Water Motors

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Will drive any class of Machinery, and work on 15 lb. pressure.

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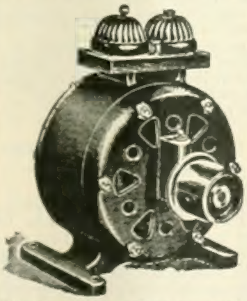

Write to us for our New Catalogue of **Alternating Current Motors,** IN SMALL SIZES.

THE CRYPTO ELECTRICAL CO.,
3, Tyer's Gateway,
BERMONDSEY.

Telephone No. 12830 Central.

PAGE & ROWLINGSON,

Chartered Patent Agents.

Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*

28, NEW BRIDGE STREET, LONDON, E.C.,
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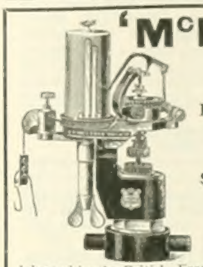

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In Two types: External and Enclosed Pressure Springs.

Each made in several forms and sizes to suit all speeds and pressures.

Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.

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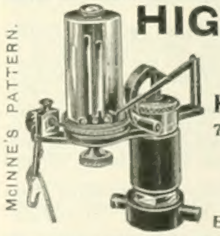
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HIGH SPEED INDICATORS.

Hannan & Buchanan,
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ENGINE COUNTERS.
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Engineering Instrument Makers

W. R. RENSHAW & Co., Ltd.,

Manufacturers of RAILWAY CARRIAGES, WAGONS, WHEELS & AXLES, and all classes of RAILWAY IRONWORK

RAILWAY WAGONS FOR HIRE.

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Price List on application to—

BOOKER & SULLIVAN,
67 and 69, Chancery Lane, LONDON, W.C.
Telephone: 9252 Central.

PAGE'S WEEKLY Contracts

CONTRACTS.

ASYLUMS COMMITTEE OF LONDON COUNTY COUNCIL.

The Asylums Committee of the London County Council are prepared to receive TENDERS for the INSTALLATION of HEATING, VENTILATING, and HOT-WATER PLANT at the Long Grove, Asylum, Epsom, Surrey, now in course of erection.

Instructions for Tender and forms of Tender and Contract, with specification and schedules thereto annexed, together with plans and cover, can be obtained from the Clerk of the Committee, No. 6, Waterloo Place, London, S.W., on or after Thursday, the 1st December proximo, on payment of a deposit of £5 for each copy. The amount deposited will, after the Committee have come to a decision upon the Tenders received, but not before, be returned to the tenderer, provided he shall have sent in a *bonâ fide* Tender and shall not have withdrawn the same.

Tenders must be on the printed form, and must be accompanied by the form of contract and schedules thereto and bond.

The Tender and accompanying documents, completed in accordance with the instructions, must be enclosed in the authorised sealed cover, endorsed "Tender for Heating, Long Grove Asylum," and be delivered at the Office of the Committee, 6, Waterloo Place, London, S.W., on or before Monday, the 23rd January, 1905, after which no Tender will be received.

Any Tender not made on the printed form, or not filled up and complete in every particular in accordance with the instructions, will be rejected.

The Committee do not bind themselves to accept the lowest or any Tender.

The contractor will have to enter into a bond in the penal sum of £2,000, with two approved sureties, each in the sum of £1,000, as security for the due performance of the contract.

R. W. PARTRIDGE,
Clerk of the Asylums Committee.

Asylums Committee Office,
6, Waterloo Place, London, S.W.,
November 16th, 1904.

COUNTY OF LONDON—THE LONDON COUNTY COUNCIL (NORTHERN) TRAMWAYS.

TO ENGINEERS, CONTRACTORS, AND OTHERS.

The London County Council invite TENDERS for the ROAD-WORK and PLATE-LAYING required for the Construction, for electrical traction on the conduit system, of the authorised Tramway in Rosebery Avenue, and of a portion of the authorised Tramway in St John Street Road, in the Metropolitan Boroughs of Holborn and Finsbury.

The total length of the above-mentioned line is equivalent to about 1¾ miles of single track.

The Contractor will be required to use the track rails with their fastenings and the slot rails, which will be furnished by the Council under another contract; but all the remaining metal work and other materials, and all the special work at junctions, crossings, cross-overs, &c., will be included in the contract.

Persons desiring to submit Tenders may, on and after Friday, 30th December, 1904, obtain the drawings, specification, form of Tender, and other particulars on application to the Council's Chief Engineer, at the County Hall, Spring Gardens, S.W., upon the payment to the Cashier of the Council of the sum of Five Pounds. This amount will, after the Council or its Committee shall have come to a decision upon the Tenders received, but not before, be returned to the tenderer, provided he shall have sent in a *bona fide* Tender and shall not have withdrawn the same, but in no case will the fee be returned unless a *bona fide* Tender is submitted.

Full particulars of the work may be obtained on application at the County Hall, previously to the payment of the fee for the specification, &c.

Tenders must be upon the official forms, and the printed instructions contained therein must be strictly complied with.

The contractors will be bound by the contract to pay to all workmen (except a reasonable number of legally bound apprentices) employed by them wages at rates not less and to observe hours of labour not greater than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract by way of schedule.

Each Tender is to be delivered at the County Hall in a sealed cover, addressed to the Clerk of the London County Council, Spring Gardens, S.W., and marked "Tender for Roadwork and Plate-laying—L.C.C. Tramways."

No Tender will be received after 10 o'clock a.m. on Tuesday, the 24th January, 1905.

Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender, and it will not accept the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened, unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the London County Council.

County Hall Spring Gardens, S.W.,
December 28th, 1904.

BOROUGH OF CAMBERWELL.

TO BRIDGE BUILDERS, BUILDERS, CONTRACTORS, AND ENGINEERS.

The Council is prepared to receive

TENDERS FOR THE CONSTRUCTION and ERECTION of a FOOTBRIDGE and APPROACH ROADS, &c., over the Surrey Canal, between Neate Street and St. George's Road, Camberwell, in accordance with the Plans and Specifications prepared by the Borough Engineer, Mr. WILLIAM OXTOBY.

Tenders, on forms for the purpose, are to be delivered, duly marked and sealed and addressed to the Works and General Purposes Committee, not later than 6.30 p.m. on Monday, January 23rd, 1905, after which time no Tender will be received. Persons tendering should be in attendance.

A deposit of £2 2s. will be required for a copy of the Specifications and Quantities, the sum to be returned on receipt of a *bonâ fide* Tender. Further particulars and Forms of Tender, &c., may be obtained at the Town Hall, Camberwell, between the hours of Ten a.m. and Four p.m., Saturday Ten a.m. to One p.m.

The Council does not bind itself to accept the lowest or any Tender. Persons tendering must comply with the Conditions as regards rates of wages and hours of labour as contained in the Form of Contract.

C. WILLIAM TAGG,
Town Clerk.

December 19th, 1904.

BOROUGH OF KIDDERMINSTER WATER SUPPLY.—CONTRACT No. 3.

The Corporation of Kidderminster is prepared to receive TENDERS for the ERECTION of ENGINE-HOUSE, BOILER-HOUSE, and CHIMNEY STACK, together with the PROVISION, LAYING, and JOINTING of about 800 YARDS of 10 in. CAST IRON DISTRIBUTING MAIN, and other works in connection therewith.

Plans and Specifications may be seen, and bills of quantities obtained, at the Offices of the Engineers, Messrs. Willcox and Raikes, of Union Chambers, 63, Temple Row, Birmingham, on or after December 30th, upon payment of a deposit of £5 5s., which will be refunded on receipt of a *bonâ fide* Tender and the return of all documents.

Sealed Tenders, on the forms supplied by the Engineers, and endorsed "Kidderminster Water Supply.—Contract No. 3," to be delivered at my office not later than Twelve noon on January 20th, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
JAMES MORTON,
Town Clerk.

Town Hall, Kidderminster,
December 19th, 1904.

COMMISSIONER FOR RAILWAYS' OFFICE,
BRISBANE, NOVEMBER 16th, 1904.

2,000 TONS OF STEEL RAILS AND 168 TONS OF STEEL FISH-PLATES.

TENDERS WILL BE RECEIVED AT this office until 2 p.m. on Tuesday, the 7th March, 1905, endorsed "Tenders for Steel Rails and Fishplates," and accompanied by a preliminary deposit of 1 per cent. on the Tender.

Specification, &c. (price 10s. 6d. per copy), can be obtained at the office of the Chief Engineer, Brisbane, on and after the 16th day of November, 1904, and also at the office of the Agent-General for Queensland, 1, Victoria Street, London, on and after January 3rd, 1905.

The lowest or any Tender will not necessarily be accepted.

T. S. PRATTEN,
Secretary.

TO ROAD BRIDGE CONTRACTORS.

THE RURAL DISTRICT COUNCIL OF Chertsey, in the County of Surrey, invite TENDERS for the CONSTRUCTION of the TWO BRIDGES known as the Plough Bridges across the River Wey, on the road from Weybridge to Byfleet.

Plans can be seen and copies of the specification obtained on deposit of a postal order of £1 (which will be returned on receipt of a *bonâ fide* tender) at the offices of Mr. R. ST. GEORGE-MOORE, M.Inst.C.E., 17, Victoria Street, Westminster, S.W., the Engineer.

The Council do not bind themselves to accept the lowest or any Tender.

Tenders to be endorsed "Tender for Bridges," and addressed to the Chairman of the Council, to be delivered at the Council Offices, No. 80, Guildford Street, Chertsey, before Twelve o'clock noon on Monday, the 30th January, 1905.

By order,
H. E. PAINE,
Clerk to the Council.

Chertsey, January 4th, 1905.

PAGE'S WEEKLY Contracts

THE SOUTH INDIAN RAILWAY COMPANY, Limited,
is prepared to receive

TENDERS FOR THE SUPPLY OF:—

(*a*) 100 STEEL COVERED GOODS WAGONS.
(*b*) 200 Pairs of SPOKE WHEELS and AXLES for ditto.
(*c*) 400 LAMINATED BEARING SPRINGS for ditto.

Specifications and Forms of Tender may be obtained at the Company's offices.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Wagons," or as the case may be, must be left with the undersigned not later than Twelve o'clock Noon of Tuesday, the 24th January, 1905.

The Company is not bound to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 20s. for each copy of Specification (*a*), and of 10s. for each copy of (*b*) and (*c*).

Copies of the Drawings may be obtained at the Office of Sir GEORGE B. BRUCE, 3, Victoria Street, Westminster, on payment of 5s. per sheet

By order,
HENRY W. NOTMAN,
Managing Director.

Company's Offices,
55, Gracechurch Street, London, E.C.
January 6th, 1905.

BOROUGH OF SWINDON.—ELECTRICITY AND TRAMWAYS DEPARTMENT.

LANCASHIRE BOILER, &c.

The Corporation of Swindon invite **TENDERS** for the **SUPPLY** and **ERECTION** of **ONE** 30 ft. by 8 ft. **LANCASHIRE BOILER** with downtake superheater, steam, exhaust, and feed piping, &c.

Copies of the general conditions, specification, and forms of Tender may be obtained on application to the Engineer and Manager, Mr. J. G. GRIFFIN, A.M.I.E.E., Electricity Works, Swindon, on payment of a deposit of One Guinea for each copy, which will be returned on receipt of a *bonâ fide* Tender.

Extra copies may be obtained at 5s. each.

The firm whose Tender is accepted will be required to find two responsible sureties, and to enter into a contract to be prepared by and to contain such clauses as the Town Clerk may deem necessary.

Tenders on the prescribed form, and accompanied by the specification and general conditions intact, and endorsed "Tender for Lancashire Boiler," to be delivered to the undersigned before 10 a.m. on Tuesday, January the 24th next.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
ROBERT HILTON,
Town Clerk.

Town Hall, Swindon,
December 23rd, 1904.

JOHANNESBURG MUNICIPAL TRAMWAYS.
The Council is prepared to receive

TENDERS FOR :—

VIGNOLES RAILS.
FISHPLATES.
ANGLE STEEL GUARD RAILS, BOLTS, NUTS, COACH SCREWS and DOG SPIKES.

General conditions, specifications, and forms of Tender are now being issued at the Offices of the Town Clerk of Johannesburg. They may be seen on and after Friday, December 30th, at the Offices of the Council's Consulting Engineers, Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and may be obtained from them on payment of Five Guineas, which will be returned on receipt of a *bonâ fide* Tender.

Tenders are to be addressed to Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and must reach them not later than Noon on Thursday, January 26th, 1905.

The Council does not bind itself to accept the lowest or any Tender, and is not responsible for the cost of Tendering.

R. FEETHAM, Town Clerk.

MONMOUTHSHIRE COUNTY COUNCIL.

ROADWAY BRIDGE OVER THE RIVER USK AT KEMEYS.

The above Council are prepared to receive

TENDERS FOR THE CONSTRUCTION

and ERECTION of a STEEL ARCHED SUSPENSION ROADWAY BRIDGE over the River Usk at Kemeys, on the site of the existing Chain Bridge Drawings can be seen either at the Office of the County Surveyor, Newport, Monmouthshire, or at the Office of Mr. JOHN J. WEBSTER, M.Inst. C.E., 39, Victoria Street, Westminster, the Engineer for the Works, on and after the 5th January, when copies of the Specification, Form of Tender and Bill of Quantities can be obtained upon payment of the sum of Three Guineas, which will be returned upon the receipt of a *bonâ fide* Tender, and the return of all documents.

Sealed Tenders are to be sent to me not later than Ten o'clock on the morning of the 19th January, 1905, and endorsed "Kemeys Bridge."

The Council do not undertake to accept either the lowest or any Tender.

H. STAFFORD GUSTARD,
Clerk to the Council.

County Council Offices,
Newport, Monmouthshire.

BOARD OF PUBLIC WORKS.—NOTICE TO CONTRACTORS.

Sealed **TENDERS**, addressed to the undersigned, will be received up to, but not later than, Ten o'clock a.m. on the 11th day of February, 1905, for **EXECUTING** certain **WORKS** at Downies Bay, County Donegal, viz.: An **EXTENSION** of the existing **PIER, DREDGING, ROCK EXCAVATION**, &c., according to the plans to be seen at the Coastguard Station, Mulroy, Larganreagh, Letterkenny, County Donegal, and at this Office, where the specification, schedule, form of contract, and printed form of Tender can be had.

The Board will not be bound to accept the lowest or any Tender.

By order,
H. WILLIAMS,
Secretary.

Office of Public Works, Dublin,
December 22nd, 1904.

APPOINTMENTS OPEN.

CARNEGIE RESEARCH SCHOLARSHIPS

The Council of the Iron and Steel Institute will shortly proceed to award Research Scholarships founded by Mr. Andrew Carnegie.

Candidates, who must be under 35 years of age, must apply before 28th February on special forms to be obtained from BENNETT H. BROUGH, Secretary, Iron and Steel Institute, 28 Victoria Street, London, S.W.

MARTELL SCHOLARSHIP IN NAVAL ARCHITECTURE

A **SCHOLARSHIP** of the annual value of £50, and subject to certain conditions, tenable for three years, will be **OFFERED** for **COMPETITION** by the Institution of Naval Architects.

Candidates must not be less than 18 or more than 21 years of age on March 1st, 1905, and must at that date have been continuously employed for two years upon naval architecture or marine engineering.

Further particulars may be obtained from the SECRETARY of the Institution of Naval Architects, 5, Adelphi Terrace, London, W.C. (envelopes to be marked "Martell Scholarship").

Applications must be sent in by February 1st, 1905.

BURNHAM URBAN DISTRICT COUNCIL (SOMERSET).

APPOINTMENT OF DISTRICT SURVEYOR, INSPECTOR OF NUISANCES, AND WATERWORKS MANAGER.

The above Council will, at a meeting to be held on Monday, the 16th day of January, 1905, be prepared to consider **APPLICATIONS** from **PERSONS DESIROUS** of **FILLING** the above **OFFICES**.

The salaries will be as follows, viz.: District Surveyor, £50 per annum; Waterworks Manager, £10 per annum; Inspector of Nuisances, £60 per annum.

The person appointed to hold the three offices.

The appointment of Inspector of Nuisances will be subject to confirmation by the Local Government Board.

The duties of the offices will be those prescribed by the Public Health Acts, the regulations of the Local Government Board, and the By-laws now or hereafter to be in force and adopted by the Urban Council, and will commence at Lady Day next.

The person appointed will be required to reside in the district, and to give the whole of his time to his duties.

Sealed applications in candidate's own handwriting, stating age and present and previous occupations, with recent testimonials as to character and competency, not more than three in number, must be sent to me on or before Saturday, the 14th day January next.

The Council do not bind themselves to appoint any applicant.

Candidates who may be selected to attend the Council on the day of appointment will receive due notice.

Canvassing will disqualify a candidate.

By order,
D. S. WATSON,
Clerk to the Council.

THE VICTORIA UNIVERSITY OF MANCHESTER.

The Council desires to proceed to the **APPOINTMENT** of a **PROFESSOR** of **ENGINEERING**.

The Professor will be responsible for the organisation of the Engineering Department, and will have the direction of the Engineering Laboratory.

He may take a consulting practice under specified conditions.

His stipend will be composed of a fixed salary and a share of the fees, and the Council guarantee that the total income will not be less than £1,000 per annum during the first three years.

A detailed statement of the conditions of appointment may be obtained from the Registrar.

Applications, with references and such testimonials (not exceeding three in number) as the candidate may desire, should be sent on or before February 15th to the Registrar.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.
Rossendale Belting Co., Ltd., 10, West Mosley Street, Manchester.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
John Thompson, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.
Hartley & Sugden, Ltd., Halifax.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.
H. J. H. King & Co., Nailsworth, Gloucestershire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
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Graham, Morton & Co., Ltd., Leeds.
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Magnesia Coverings, Ltd., Washington Station, co. Durham.

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E. Green & Son, Ltd., Manchester.

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Hughes & Lancaster, 47, Victoria Street, London, S.W.

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Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Bruce Peebles & Co., Ltd., Edinburgh.
Brush Electrical Engineering Co., Ltd., Victoria Works Belvedere Road, London, S.E.
Crompton & Co., Ltd., Arc Works, Chelmsford.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
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Matthews & Yates, Ltd., Swinton, Manchester.
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Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
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Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Premier Electrolyte Co., 26, Spital Square, London, E.
Simplex Steel Conduit Co., Ltd., 20, Bucklersbury, London, E.C.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Electric Lighting).
J. & H. McLaren, Midland Engine Works Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Momentum Engine, 19, 19a, Imperial Buildings, Ludgate Circus London, E.C.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

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Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

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E. J. & J. Pearson, Ltd., Stourbridge.

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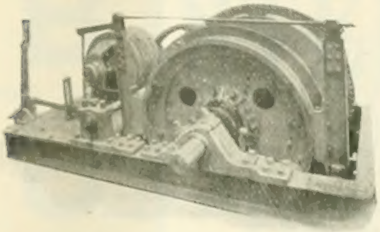

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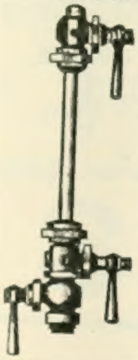

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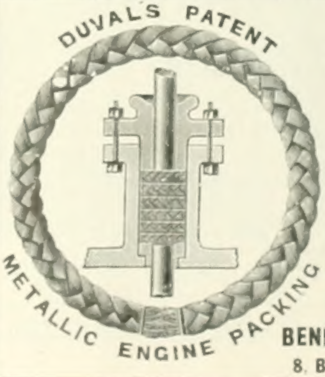

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Mabie, Todd & Bard, 93, Cheapside, London, E.C.

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Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

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Graham, Morton & Co., Ltd., Leeds.
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Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

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Klinger, Richard & Co., 66, Fenchurch Street, London, E.C.

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Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C.
Wild, M. B., & Co., Corporation Street, Birmingham.

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Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

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J. B. Treasure & Co., Vauxhall Road, Liverpool.

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Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

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See Conveying Machinery.

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Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

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Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

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Hannan & Buchanan, 75, Robertson Street, Glasgow.

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Farnley Iron Co., Ltd., Leeds. England.
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Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co,, Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
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Woodhouse & Rixson, Sheffield.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
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Richard Klinger & Co., 66, Fenchurch Street, London, E.C.

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Bradbury & Co., Ltd., Wellington Works, Oldham.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax
Northern Engineering Co. (1900 Ltd., King Cross, near Halifax.

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W. Summerscales & Sons, Ltd., Engineers Phœnix Fourdry, Keighley, England.

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Waygood & Co., Ltd., Falmouth Road, London, S.E.

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Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Greenwood & Batley, Ltd., Leeds.
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W. Barns & Son, Chalton Street, Euston Road, London, N.W.

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Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Humbolt Engineering Co., Kalk, near Cologne, Germany.

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Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Partridge & Cooper, Ltd., 191-192 Fleet Street, London, E.C.
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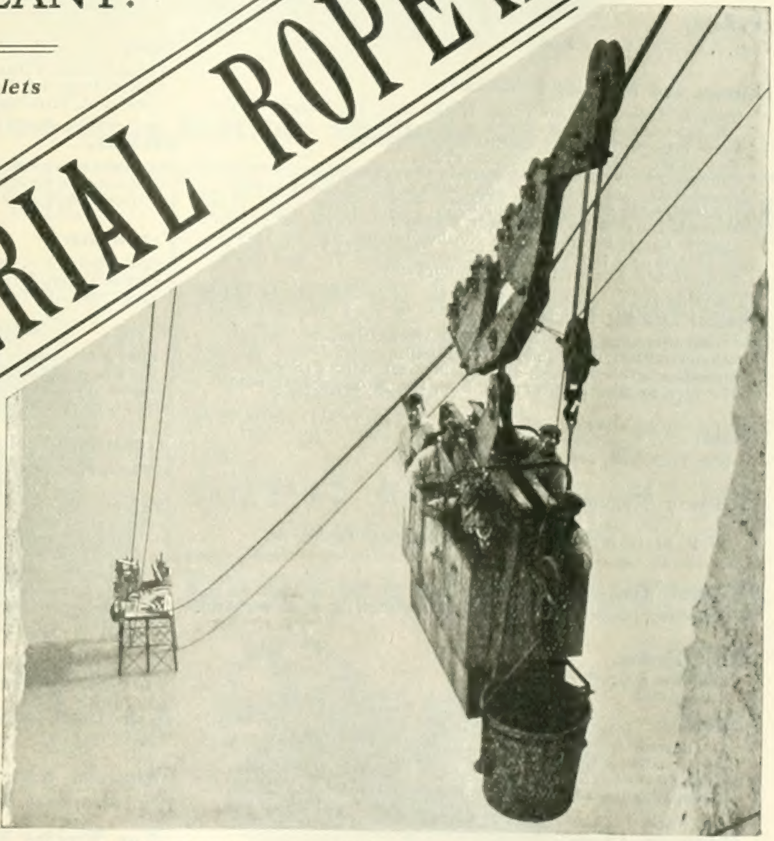

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Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pulleys.

H. J. H. King & Co., Nailsworth, Glos.

Pumps and Pumping Machinery.

Blake & Knowles Steam Pump Works, Ltd., 153, Queen Victoria Street, London, E.C.
Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

William Asquith, Ltd., Highroad Well Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
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Rails.

Wm. Firth, Ltd., Leeds.

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Ropeways (Aerial).

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Holmes & Co., W. C., Huddersfield.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

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Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

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Lassen & Hjort, 52, Queen Victoria Street London, E.C.

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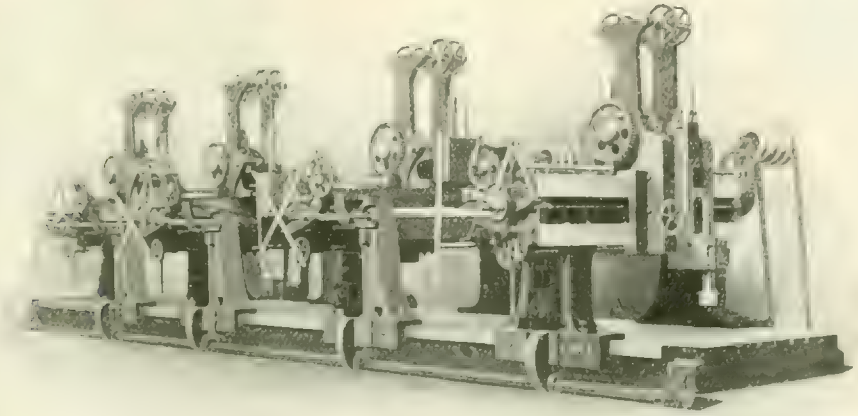

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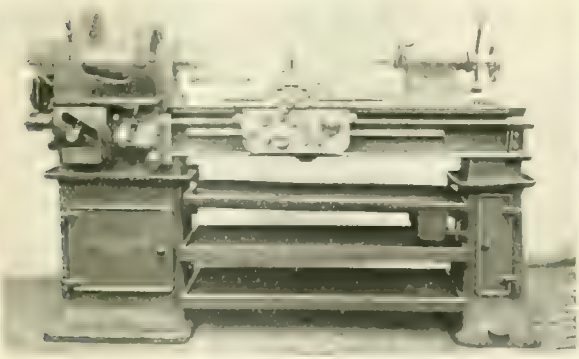

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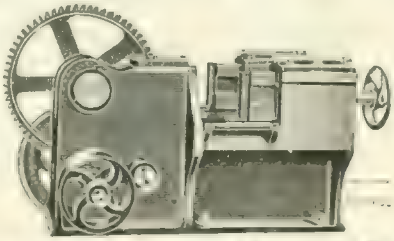

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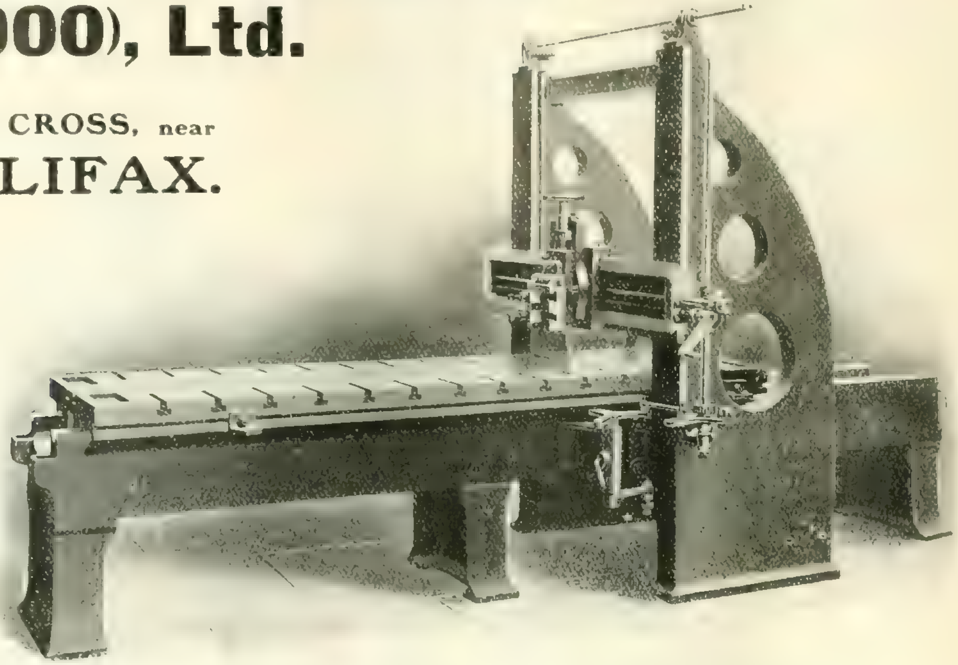

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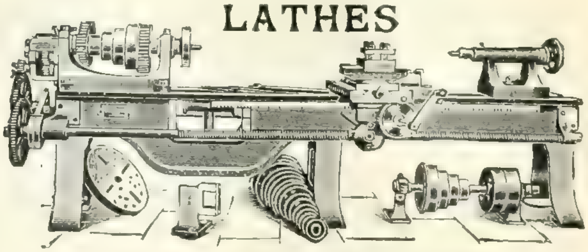

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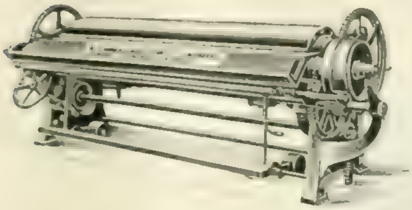

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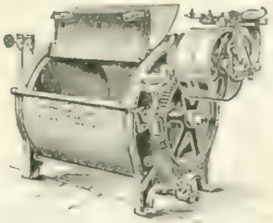

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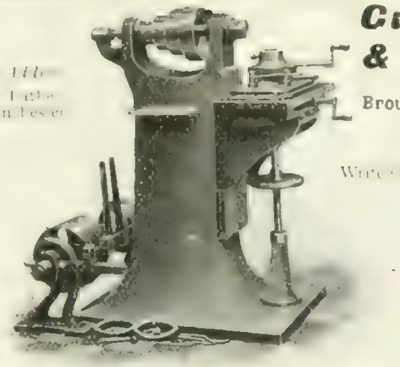

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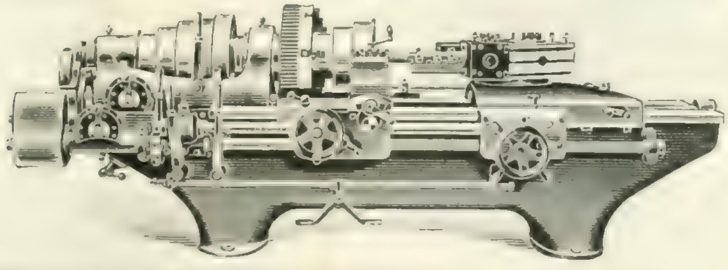

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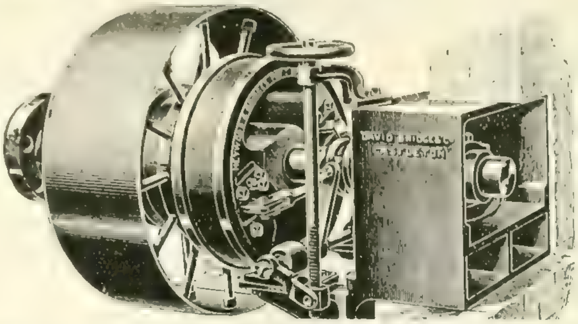

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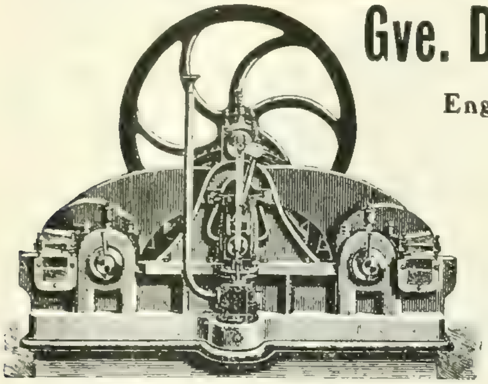

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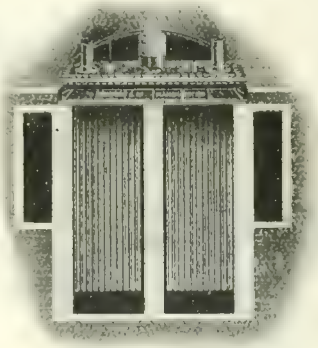

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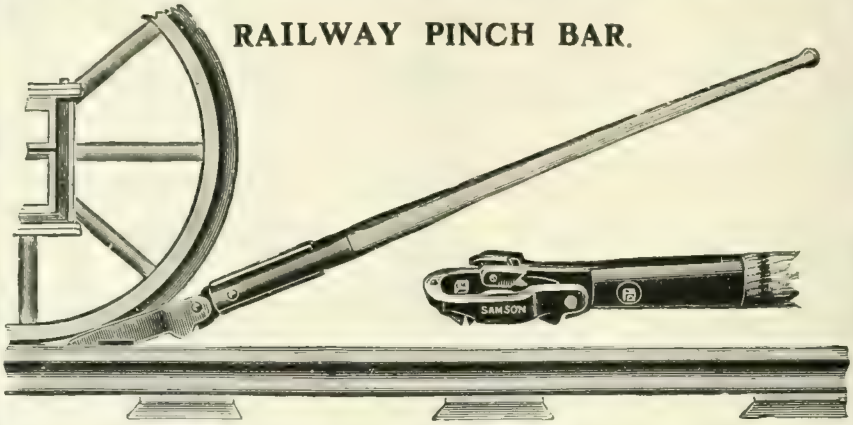

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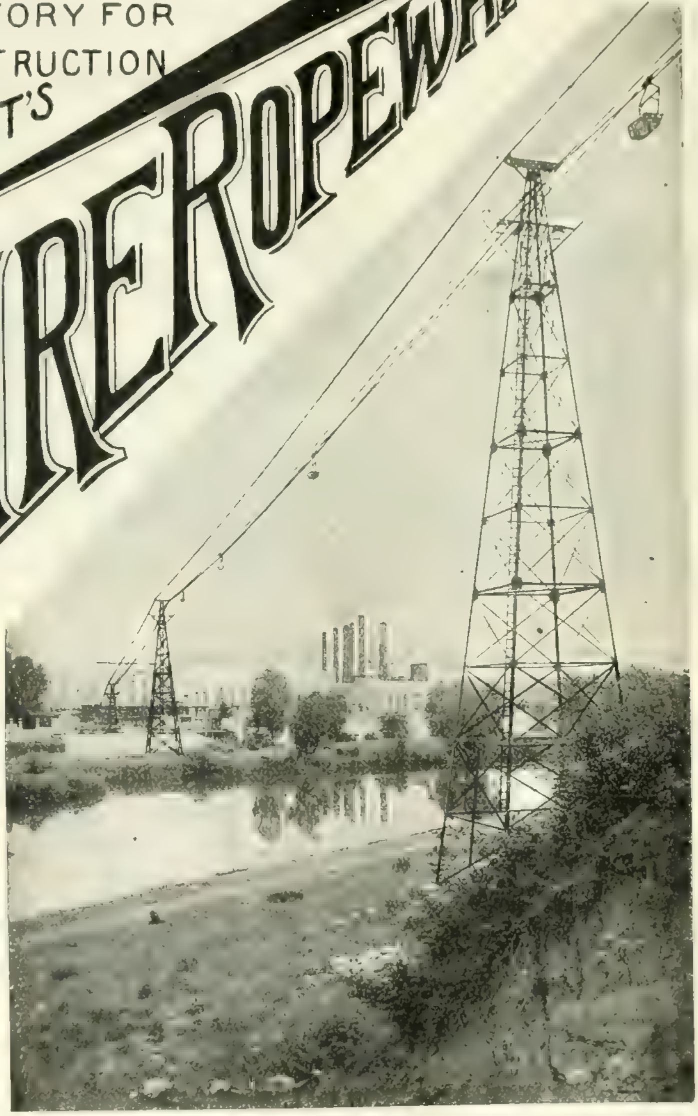

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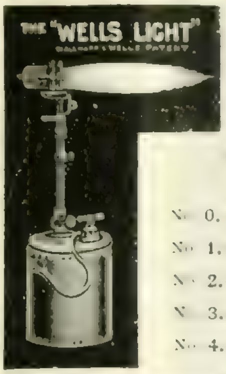

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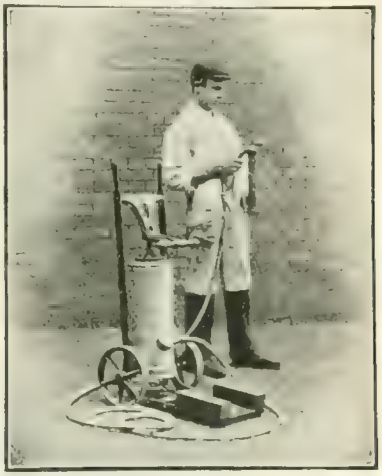

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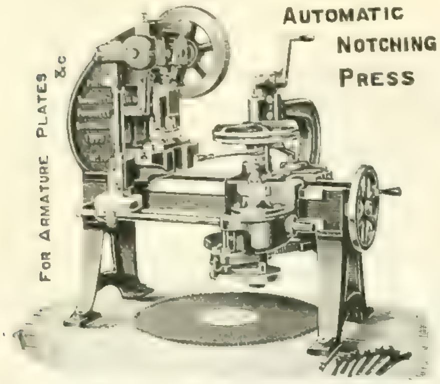

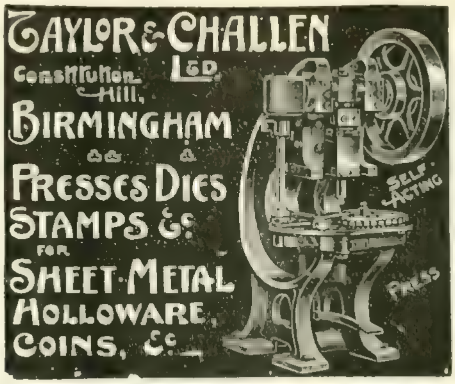

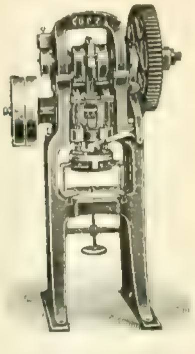

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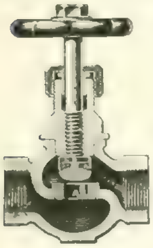

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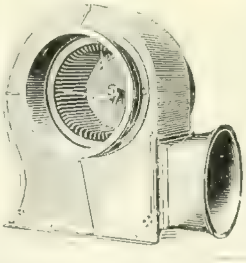

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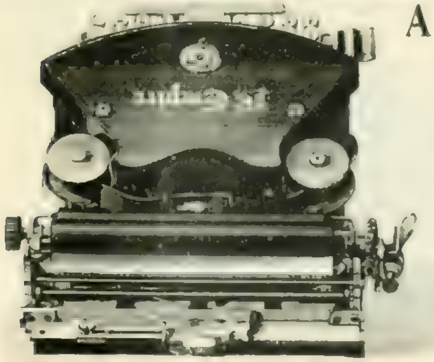

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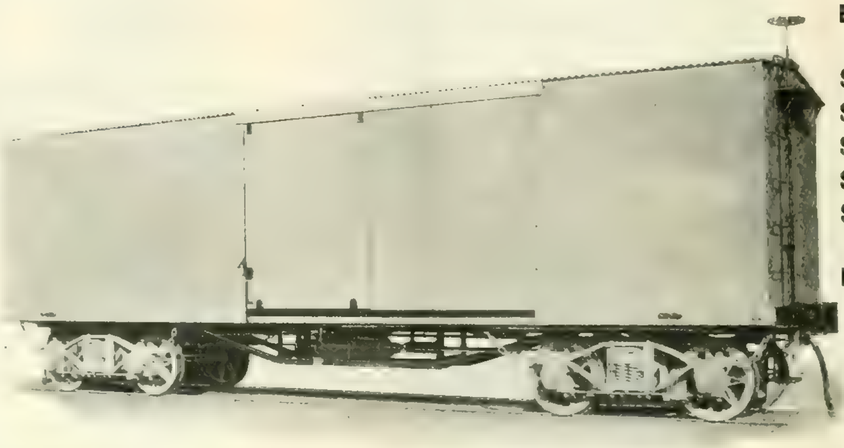

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VI. LONDON, FRIDAY, JANUARY 13, 1905. No. 18.

The Offices of "Page's Weekly," Wednesday, Midnight.

HOWEVER efficient the furnace may be, when considered merely as an apparatus for the combustion of fuel, the means of absorbing and transmitting the heat generated to the water in the boiler, are at least equally worthy of careful consideration. The ideal furnace is not surrounded by comparatively cold water-space walls, but by heat-reflecting surfaces of fire-brick, whereby the high temperature essential to perfect combustion is attained, and I have already advocated the use of such a furnace or combustion chamber as an adjunct to the boiler.

To ensure the condition of working a furnace through the maximum range, we must not only have the highest initial temperature, but the lowest practicable final or chimney temperature; this being evidently determined by the efficiency of the heat-absorbing surfaces of the boiler. Under ordinary conditions it is seldom that the temperature of the gases at their exit from the boiler can be got much below from 500 to 600 deg F. Again, with natural draught, the efficiency of the chimney is at its maximum when the unit weight of the gases passing through it is one half that of the air at the outside temperature. Supposing this to be at 62 deg. F., the temperature of the gases within the chimney, to fulfil this condition would have to be 552 deg. F.; assuming 24 lb. of air to be drawn in and burnt with each pound of coal, there would be nearly 25 lb. of gases to be heated through 490 deg F. Their specific heat (or the quantity of heat required to raise the temperature of one pound of gases through one degree F.) is ·238 of a heat unit. So 25 × 490 × ·238, or 2,915 heat

MONUMENT TO PETER TUNNER, THE FATHER OF THE AUSTRIAN IRON TRADE.

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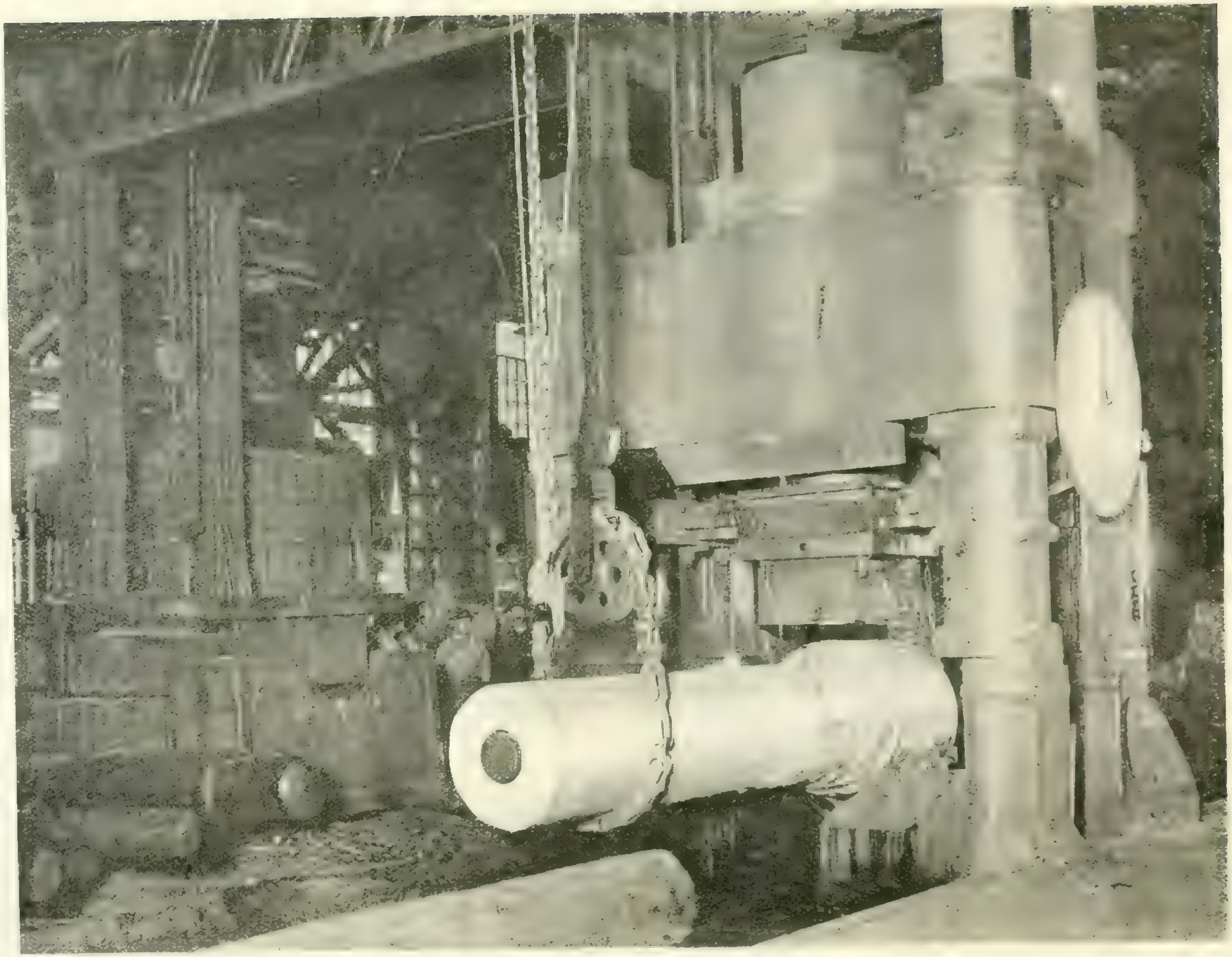

FORGING A 12-IN. GUN TUBE IN THE BETHLEHEM STEEL WORKS.

The block has a hole bored through its centre, and in this the mandrel is inserted, the tube being forged around it. The hydraulic pressure for this 5,000-ton press is furnished by Whitworth pumping engines. The department also contains a 2,500-ton press of similar design. (*See page* 60.)

units are, in a sense, utilised in producing the draught in the chimney. Taking the heat value of the coal as 14,000 units, this amounts to nearly 21 per cent. of the whole value of the fuel.

This seems a heavy price to pay, but it must be remembered that the temperature of the water on the other side of the plates or tubes forming the heating surfaces may be 350 deg. or more, and that at any rate the products of combustion could not, without abstracting heat from the water, leave the flues at a lower temperature than this. In loco-type boilers it is well known that far more water is evaporated by the heating surface of the firebox in proportion to its area than by any other in the boiler. The results of experiments on the different portions of the heating surfaces of boilers differ so much that it is impossible to fix any very definite figures, but we may take it that the efficiency of the firebox in terms of the total heating surface is from 50 to 66 per cent. of the whole. One case is recorded by Mr. Hutton in which 70 per cent. of the whole evaporative duty was borne by the firebox; 15 per cent. by the first quarter of the tube surface; 7 per cent. by the second quarter; 3 per cent. by the third; and 2 per cent. by the last quarter. With an initial temperature of 2,500 deg. F. this would result in the escape of the gases at a little over 600 deg. At any rate this is sufficient to show the rapidly diminishing value of the heating surface; each successive equal portion transmitting a less and less quantity of heat, so that an enormous addition to the tube surface would be required to materially reduce the temperature below that actually utilised in producing natural draught. In Lancashire boilers the case is very much the same, the furnace tubes performing nearly all the evaporation, especially when conical cross tubes are fitted in the flues. These, it may be noted, should be placed as far as possible from the fire, otherwise they have the effect of extinguishing flame and lowering the temperature of the furnace gases by abstracting heat before combustion is completed.

But to return to the escaping gases. Although practically incapable of imparting further heat to water at temperatures corresponding to high pressure of steam, there is a considerable field of usefulness open to them before making their final ascent through the chimney. By their passage amongst the numerous tubes of the well-known Green's economiser their heat is greedily absorbed by the cold feed water passing through the tubes, with the result, to quote a recorded test, that while the gases were chilled down from 618 deg. F. to 365 deg. the temperature of the feed-water was raised thereby from 88 deg. to over 225 deg. The rapidity of ascent of the column of gases within a chimney is measured in inches of water, and the simple apparatus necessary to register this is a useful addition to any steam boiler. If the draught, when everything is in the best working order is known, the stoker will have to keep his fire of proper thickness, evenly spread, and his firebar air-spaces clear, or his lack of attention will be visible at the draught gauge. It consists of a glass tube, any diameter, bent into the form of the letter U, one end being in communication, by an iron pipe, with the current of gases within the smokebox or the flue at the base of the chimney, while the other end is open to the atmosphere; a small quantity of coloured water being poured into the tube, the difference of level in the two legs of the U will show the pull of the chimney, and may be directly measured either by the scale attached, or by an ordinary rule.

Water is just 820 times as heavy as air at 62 deg. F., hence an inch of water would balance a column of air 820 in. in height. Against this, however, we have to set the weight of the column of heated gases within the chimney, which at 552 deg. F. is one-half that of the external air, the resultant effect being, under these conditions, that one inch difference of level in the two legs of the gauge indicates a draught or pull due to a column of the lighter gases, 1,640 in., or say, 137 ft., in height. The draught in inches of water, therefore, at or near the inside and outside temperatures mentioned, equals ·0073 times the height of the chimney in feet. If the heating surfaces are covered upon the fire side with soot, or upon the water side with scale (or, far worse, with a layer of grease) the increased temperature of the gases passing away will cause a measurable difference in the draught, and indicate the need for examination.

CORRESPONDENCE.

[illegible] near Manchester,

January 5th, 1905.

To the Editor of PAGE'S WEEKLY.

DEAR SIR,—As from time to time doubts have been expressed in your journal as to the steam raising value of towns refuse, we enclose extract of letter from the engineer-in-charge of the destructor plant at Burnley, where the results are so satisfactory that they have now had built a further installation to deal with the balance of the refuse of the borough. We doubt if there are many coal fired boilers of the same size giving as much steam when burning best Welsh coal, whereas our fuel is unscreened towns refuse.

Yours truly,

MELDRUM BROS., LTD.

The extract referred to from the Heywood Advertiser, October 21st, 1904, *re* Burnley Destructor, is as follows:—

Until the end of August last a weekly return of water evaporated by the boiler was sent to the members of the Health and Electricity Committee. This water was measured by a Kennedy hot water meter, and for several weeks was checked by an automatic recorder on our 6 by 15 Weir pump. Just recently the makers of the meter have certified it as working correctly. The following figures are taken from the weekly returns for the quarter ended on June 25th :—

Refuse weighed in Tons.	Water evaporated in lb.
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
211	638,100
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

In each of the above cases, except the last, the water evaporated is for six days; in the last case it is for seven days.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

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Foreign and Colonial Subscribers receiving incomplete copies, through newsagents, are requested to communicate the fact to the Publisher, together with the agent's name and address.

New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be received **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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NEWS ITEMS.

[illegible] Wolfe Barry, [illegible] between the Barry Company's line and the Brecon and Merthyr line.

A Times naval correspondent states that considerable alterations and additions are being made [illegible] fuel as an alternative to coal.

Messrs. Andrew Brown and Co., of 110, Cannon Street, London, E.C., have been appointed the London and District Agents for Messrs. Penman and Co., boiler makers, Glasgow.

Professor Gisbert Kapp, whose brief biography recently appeared in PAGE'S WEEKLY, upon his appointment at Birmingham University, has been made an honorary member of the Physical Society of Frankfort.

The Phœnix Dynamo Manufacturing Company, Ltd., of Thornbury Works, Bradford, have opened an office at 17, Victoria-street, Westminster. This will be in charge of Mr. E. W. T. Ward, who has recently joined their staff as London representative.

It is announced that the Lancashire and Yorkshire Railway Company have purchased the fleet of the Goole Steam Shipping Company, consisting of eighteen steamers, and will run them to the Continent in connection with their railway service to the East Coast.

We hear that Mr. P. M. Sankey has left the firm of Messrs. Johnson and Phillips, where for the past seven years he has been works manager of the Electric Cable Works. We wish Mr. Sankey every success in the future.

Sir William H. White, K.C.B. (Director of Naval Construction and Assistant Controller of the Royal Navy, 1885–1902), has commenced practice at 8, Victoria Street, Westminster, S.W. By wire he will be addressed, "Navalhood, London," and by telephone, 1505, Westminster.

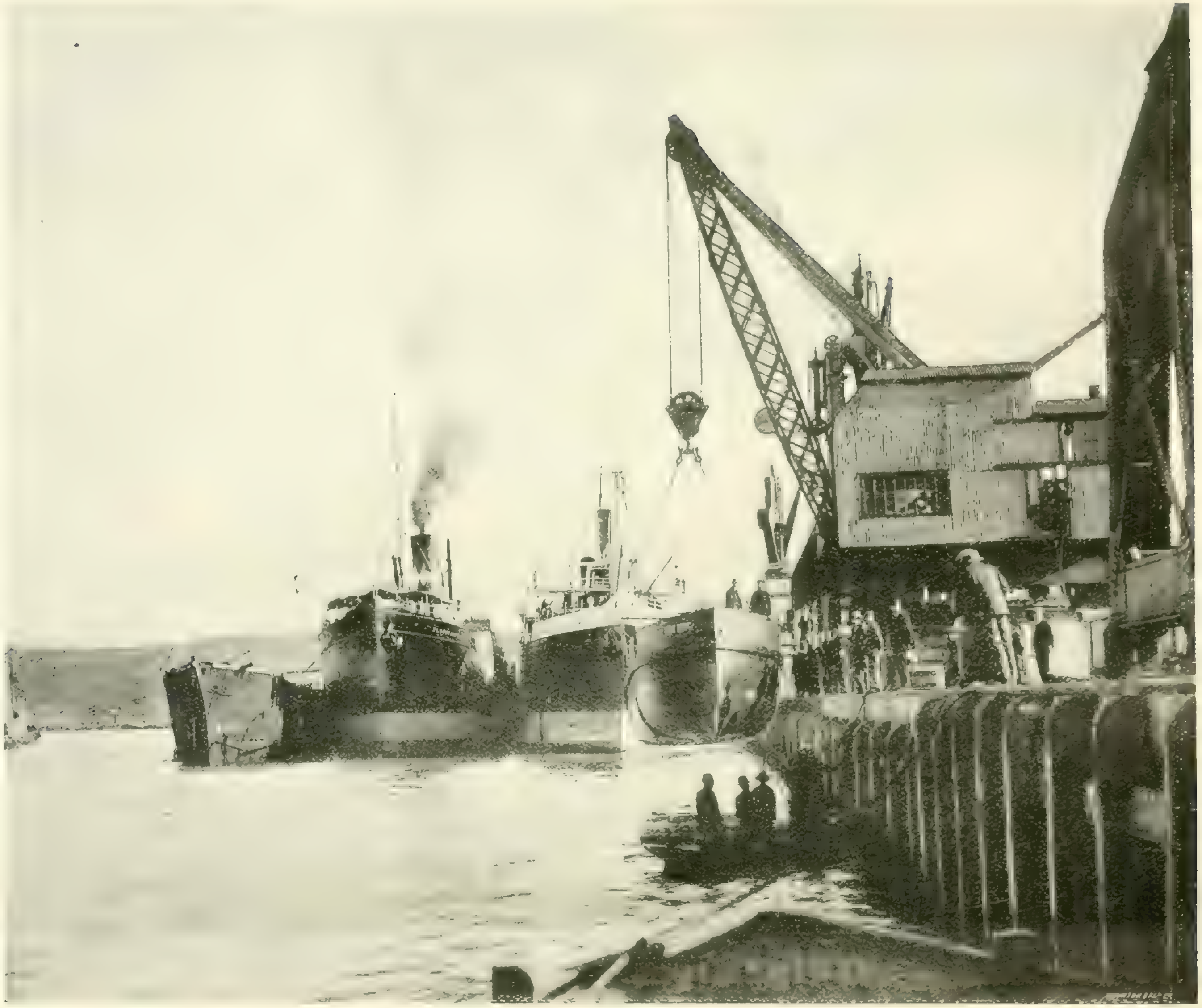
Mr. Charles De Grave Sells, M.Inst.C.E., who went to Italy some eighteen years ago under an arrangement with the Italian Minister of Marine, is now practising on his own behalf, and is acting as the representative of English firms in connection with marine engines and machinery, etc. His official address is Cornigliano, Ligure, Italy.

[illegible] made with the new University buildings at Birmingham. One of the large engineering blocks is now roofed in, and shafting for driving the metal and wood-working machines is being erected. For the special vacation course in metallurgical work, conducted by Professor Turner, the maximum number of students has already been enrolled.

Sir James Dewar, at a meeting of the Royal Society of Edinburgh, said he felt it a very high honour to follow in the footsteps of the great man who had already received the Gunning Victoria Jubilee prize. It was his intention to hand over the money value of the award to the University of Edinburgh so that it might go towards the fund being raised for the memorial of the late Professor Tait.

The Peter Tunner Memorial.

[illegible] iron trade, Peter von Tunner, died at Lesben at the age of 89 years. The work begun by Tunner in 1840, as lecturer on the metallurgy of iron and continued with astonishing energy for a lifetime, was the foundation of scientific metallurgy. He was one of the first to appreciate the importance of the Bessemer process, and its introduction into Austria was due to his energy. As an author he was continually active. His last monograph was an account of the iron industry of Styria, prepared on the occasion of the visit of the Iron and Steel Institute to Austria in 1884. Honours were showered upon him by monarchs, municipalities and scientific societies. In 1878 he received the Bessemer Gold Medal from the Iron and Steel Institute of which he had long been a member. His services to metallurgy have not been forgotten since his death, and a worthy monument to his memory has now been erected at Lesben, the scene of his long-continued activity, funds for the purpose having been contributed by his former pupils and by members of the Mining Society of Styria, of the Iron and Steel Institute, and of other societies of which he was an honorary member. The monument was recently unveiled with great ceremony. It is constructed of granite with the figures in bronze. A mining student and an iron-smelter are represented in the act of winding an oak and laurel wreath round the base of the bust. The sculptor was Mr. Carl Hackstock.



(From *The Syren and Shipping*.)

BUFFALO HARBOUR, EAST LONDON. FIFTY-TON CRANE LOWERING NEW FIRE FLOAT INTO RIVER AFTER LANDING EX. SS. "FORT SALISBURY." WEIGHT, 35 TONS.

Harbour Works at East London.

The writer of an article on "The Ports of South Africa," in the new year's number of the Syren and Shipping, makes some comments on the Port of East London, which illustrates forcibly the difficulties which were encountered in dealing with the river bar.

East London, he says, has an admirable inner harbour, access to which, however, is sometimes impossible, on account of the bar and narrow ingress, obstructed, as this has been, by a ridiculously extended middle training wall, devised in days when what were known as "freshets" used to occur frequently on the Buffalo River (which forms the inner harbour), and "scouring" methods were the best approved and most in vogue for the bar clearance. Curiously enough, these freshets have almost entirely ceased to operate in the Buffalo channels, and the training wall, which was meant to co-operate with nature, has latterly proved an artificial obstruction to the entrance of long vessels, unless at considerable risk. The harbour problem at East London is not so much one, as at Durban, of depths on the bar, or of draughts of vessels crossing the same, but of access in the steering ways and of width of entrance or egress channels.

The engineering which narrowed the channel to assist a natural scour was right, so far as it went, for the day or the conditions it had to contend against; but it was not prospective engineering; and when the natural scour surceased, almost, if not quite permanently, the narrowness of the entrance channel and the meagreness of steering and turning way, consequent upon the existence of the middle training wall, became a fresh adversity. In face of this, however, betterment has been gradually achieved; and, although the conditions at the Buffalo mouth cannot hold a candle to those at the entrance to Durban harbour, yet there is every indication that in the future the reverse may be the case. So long as a vessel does not exceed 20 ft. or 21 ft. draught and 450 ft. length, she can enter at most states of the tide or sea, and, once inside, can lie in smooth river waters alongside wharves which are fitted with the latest and best appliances for landing and clearing cargo.

The article from which the above details and the illustration on the opposite page are taken, is only one of many features of interest in this excellent number which gives a comprehensive resumé of the progress [illegible] shipping [illegible] during the past year.

A Theory of Water-finding.

The Times is apparently trying to clear up the mysteries attendant upon water-finding, and in Wednesday's issue an interesting theory is advanced by Mr. Sydney F. Walker, of Bath. There is so much misapprehension as to the forces underlying the operations of the professional water-finder, and his occupation, in spite of practical success, is so often looked upon as a species of charlatanry, that any attempt to explain the matter scientifically is worthy of more than passing notice. We have no space to quote from Mr. Walker's column at length, but his ideas are given in brief in the following paragraph.

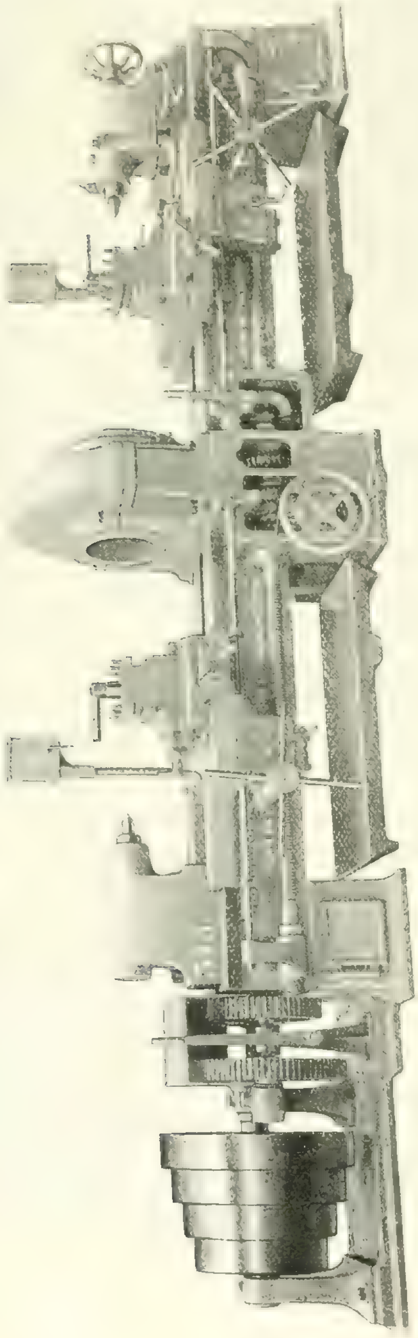
The operator, he says, is merely the instrument that responds to the force generated by the underground spring, just as a gold-leaf electroscope responds to the force delivered by an electrostatic charge. A portion of the energy present in the running water underground is converted into a form of energy that has been hitherto unknown, and is at present without a name, but which possesses some of the properties of the other physical forces and responds to some of their laws. The principal property it possesses, so far as is known at present, is that of stimulating the nerves controlling some of the muscles of the hands, and thereby causing certain muscular movements of the fingers, which are rendered visible usually by the forked twig that has become associated with the operation of water-finding. The forked twig is merely the indicator, showing the presence of the energy transformed by the running water, just as the diverging gold leaves of an electroscope indicate the presence of an electrostatic charge. The energy, in the form described, passes from the ground, up through the body of the operator, to the nerves controlling the muscles of the hands, producing in those muscles the movements which cause the twig to turn.

Geological Society Awards.

The council of the Geological Society of London will this year award the medals and funds in their gift as follows: The Wollaston medal to Dr. J. J. Harris Teall, M.A., F.R.S.; the Murchison medal to Mr. Edward John Dunn, of Melbourne; the Lyell medal to Dr. Hans Reusch, Director of the Geological Survey of Norway; the Bigsby medal to Professor J. W. Gregory, D.Sc., F.R.S.; the Wollaston fund to Mr. H. H. Arnold-Bemrose, M.A.; the Murchison fund to Mr. H. L. Bowman, M.A.; and the Lyell fund to Mr. E. A. Newell Arber, M.A., and Mr. Walcot Gibson.

IMPROVED DOUBLE-AXLE TURNING LATHE.

We are indebted to Messrs. John Hetherington and Sons, Ltd., for the accompanying illustration showing improvements which have been recently made in double-axle turning lathes for high-speed cutting.



IMPROVED DOUBLE-AXLE TURNING LATHE, BY MESSRS. JOHN HETHERINGTON AND SONS, LTD.

These lathes are specially designed for turning at high speed each end of an axle at the same time. The axle is revolved in dead centres and is driven by a hollow spindle headstock through a Clements driver. Independent starting, stopping and reverse, self-acting sliding motion is given to each carriage by two separate steel guide screws and gun metal half nuts with instantaneous release motion. There is a fixed ratio of positive and continuous feeds, giving 32, 16, 8, and 4 cuts per inch traverse through cut gearing. This can be changed by the indexed hand wheel in front of the lathe while the latter is in motion. Each carriage is also fitted with an adjustable independent automatic stop motion to the feed in both directions.

The lathe is fitted with compound slide rests, one to each saddle, with a revolving steel capstan tool holder suitable for two tools; also with spring catch and locking handle. The bottom slide and carriage form drain troughs, collecting and delivering the lubricant into trays beneath the bed.

The driving headstock is of massive design, the hollow cast-iron spindle revolving in adjustable parallel bearings, and the cap and headstock forming an entire cover to the main driving wheel on the spindle.

The dead centre headstocks are movable, the right-hand one being fitted with a sliding spindle of hard steel, adjustable by screw and handwheel, split nose, locking bolt and centre. It is mounted on a saddle fitted with a coarse pitch screw, by which means it can be quickly traversed transversely in order to pass the axle through the driving headstock spindle. The left hand dead centre headstock is fitted with a fixed spindle and loose centre.

The lathe is driven by a four-speed cone pulley of large diameter suitable for a wide belt of high velocity, while the double cut gear provides for an instantaneous change from high-speed cutting to slow-speed cutting for finishing, etc.

The following are the chief dimensions:—

Height of centres, 13 in.; to turn in diameter up to 8½ in.; to admit between centres, 8 ft.; diameter of hole through spindle, 12 in.; length of bed, 13 ft.; width and depth of bed, 20 in. by 12½ in.; gear ratio, 9·23 and 33·6 to 1; diameter of pulleys and speed of countershaft, 22 in. by 7 in.: 460; cutting speeds per minute at maximum diameter 75, and with belt on large step of bottom cone pulley, 20; Approximate b.h.p. required, 27; approximate weight of lathe, 130 cwt.

NAVAL NOTES.

WEEKLY NOTES ON NAVAL PROGRESS IN CONSTRUCTION AND ARMAMENT.

(BY OUR NAVAL CORRESPONDENT.)

FRANCE.

THE boilers of the two armoured cruisers *Jules Ferry* and *Jules Michelet* will be of the *Du Temple-Guyot* type, with small tubes, but the majority of the other vessels under construction will be fitted with Niclausse or Belleville steam generators with large tubes.

It appears that when the battleship *Justice* was launched by the Société de la Mediterranée, her hull was considerably strained, and an inquiry is to be held into the manner in which vessels are launched by this company.

The next programme of construction is expected to contain particulars of a new class of protected cruiser, approximating to the scout type of the British navy. They are to be of 3,000 tons displacement, with 26 knots speed, and the first batch will probably be laid down in the course of this year.

GERMANY.

Progress with the new battleships for the German navy is rapid, but it is noteworthy that like the *Schwaben*, the *Elsass* has met with a serious accident while running her trials. She was finishing her circle turning trials according to one report, when she lost her rudder, owing to the pressure of water. Although this report is quite credible, there must have been something seriously wrong with the construction of the vessel, and she will be some little time making good the damage done. The battleship *Braunschweig* on her full power trials made an average of 18·43 knots, and at an endurance trial of eleven hours' duration the average indicated horse-power was 11,588. The armoured cruiser *Friederich Karl* has not given very satisfactory results on her trials, only attaining 18·7 knots with 17,759 horse-power, and later under better conditions of wind and weather, 20·5 knots. The protected cruiser *Bremen* made an average 23·25 knots on her full power, her highest speed being 24·466 knots. Two seagoing torpedo boats, Nos. 123 and 125, the latter fitted with turbine machinery, have made over 28 knots on trial. An accident occurred to the *Prinz Adalbert* when steaming at full speed on her trials, the high-pressure cylinder of one of her engines bursting.

RUSSIA

"The Emperor has sanctioned the expenditure of £160,000,000 for rebuilding the Russian navy." In these bald words the St. Petersburg correspondents announced the new scheme for the replacing of the squadrons which Russia has lost in the war. The programme is to cover ten years, and many of the vessels will be built abroad. The building programme is to consist of eight battleships of the *Kniaz Suvaroff* type, eight of the *Andrei Pervosvannui* class, six armoured cruisers, twelve protected cruisers, fifty destroyers, and one hundred torpedo boats.

The Third Pacific squadron which is fitting out in great haste at Libau will take practically every remnant of the Russian fleet from European waters, with the exception of the Black Sea Fleet, which is pinned up behind the Dardanelles. Whether the squadron under Admiral Mebagatoff will be ready to start in another fortnight is doubtful, but urgent commands have been issued for it to do so.

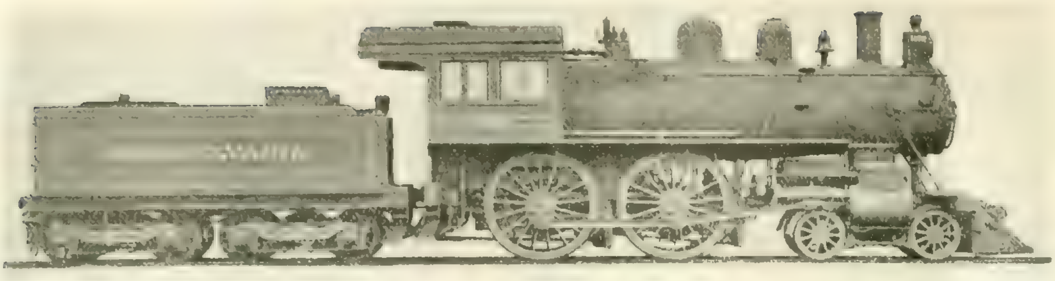
UNITED STATES.

The new battleship *New Hampshire* will be built by the New York Shipbuilding Company, and the contracts for the two armoured cruisers *North Carolina* and *Montana* have been awarded to the Newport News Company. The battleship is to be completed in thirty-eight months.

Two more submarines have been ordered from the Holland Submarine Company, and unless the Latre Company come forward and compete, the remainder of the appropriation authorised by Congress in the summer will be expended on *Holland* boats. There are already eight submarines of this type in the United States' navy.

THE NETHERLANDS.

The Dutch Navy budget for 1905 provides for the completion of the battleship *Tromp*, the four torpedo boats, G1–4 (of which G 1 was launched on December 17th and G 2 on December 28th, by the Schelde Company), and one submarine. A new battleship "E" is to be laid down and four more torpedo boats, sisters to G 1, are to be begun. The torpedo boats Tangka, Wajang, and Smeroe have made 25·6, 24·7, and 24·6 knots respectively on trial.



SUBURBAN LOCOMOTIVE, PENNSYLVANIA RAILWAY.

SUBURBAN RAILWAY TRAFFIC.

By A. W. Sullivan.

THE advent of the electric tram has compelled the attention of railway men, and it is therefore not surprising to find that the question of suburban traffic has been very carefully considered by the International Railway Congress. In response to a circular of inquiry by the Congress on the question of suburban traffic, replies were received from one hundred and twenty-nine railways, of which ninety-seven stated that they had no suburban traffic, and thirty-two gave information which forms the basis of a report by Mr. A. W. Sullivan. Of these railways, twenty-eight are in the United States, one in Canada, two in the Argentine Republic, and one in Brazil.

TOLLS, FARES, AND TICKETS.

In the United States and Canada, it is the universal custom to provide but one class of car in suburban service. A distinction, however, is made in the use of cars, smoking being permitted in some but not in others. In many of the Southern States separate cars are required by law to be provided for the exclusive use of negro passengers.

Upon the railways of the Argentine Republic and of Brazil both first-class and second-class cars are used. It is found to be the almost universal practice to charge fares in suburban service varying according to distance. An approximation to a zone system of fare is made upon some roads, where for convenience in accounting, several stations near together are placed in a group, and tickets for different stations in each group sold at the same rate; or, where competitive conditions restrict the fare that may be charged to a number of stations in quite an extensive district; but such instances of zone rates are not the result of a systematic development of the zone system, which it may be said has no general application in America.

Great variation is found to exist in the suburban rates of fare as compared with the ordinary rates. Upon some railways the suburban rate is as low as one-fifth of the ordinary rate, while upon others the full ordinary rate is charged, the range being as follows:

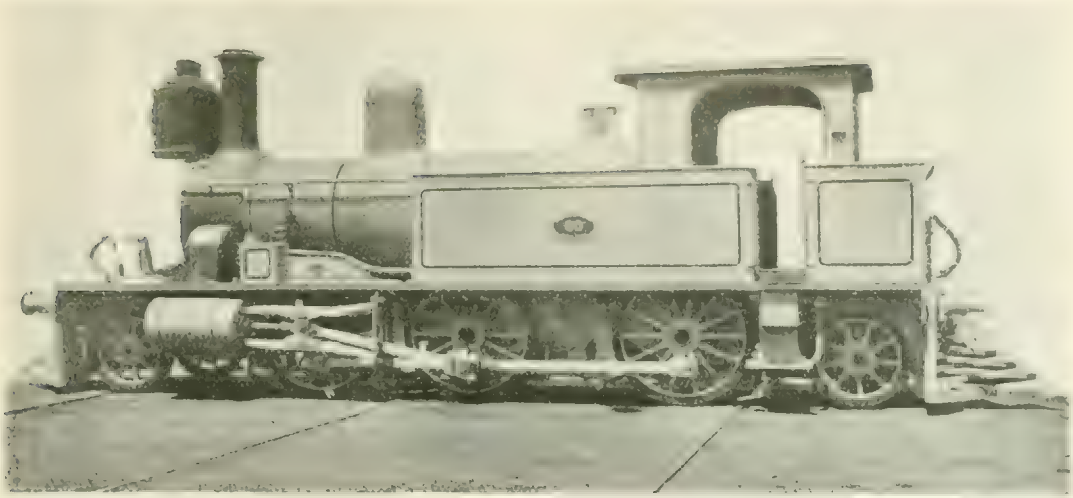
Number of railways	Proportion of suburban to ordinary fares.	Number of railways.	Proportion of suburban to ordinary fares.
3	$\frac{1}{5}$	1	[illegible]
1	[illegible]	1	[illegible]
5	$\frac{1}{3}$	6	Full rates.
[illegible]	[illegible]		
3	[illegible]	[illegible]	

From the foregoing statement it will be seen that the average proportion of the suburban rates is 59–100 of the ordinary rates of the railways in the United States and Canada.

In Argentina, the suburban rates to near-by stations are in some instances higher than the ordinary rates for equal distances; to stations 8 and 9 miles distant, the suburban rates are about the same as ordinary rates; and for stations 10 to 13 miles distant, the suburban rates are somewhat less than ordinary rates, the average for all distances being about equal to ordinary rates.

The second-class rates in suburban service are found to average about 65 per cent. of the first-class rates for all distances.

The round trip rates average 80 per cent. of the rates for two single trips.



SUBURBAN LOCOMOTIVE—FERRO CARRIL DEL SUD (ARGENTINA).

Some difference of practice is found to exist upon railways in the United States and Canada in the matter of carrying of baggage upon suburban trains. In all cases, however, where baggage is handled the allowance is 150 lb. per passenger. In Argentina, all trains carrying passengers convey baggage, 110 lb. being the maximum weight allowed each passenger.

It is the universal practice in all countries to permit passengers to take with them into the cars such parcels and packages as may be disposed of under the seats or in racks overhead, without inconvenience to other passengers.

The forms of tickets used appear to be of endless variety in size, shape, colour, and the conditions under

SUBURBAN LOCOMOTIVE (LOCAL SERVICE), CHICAGO AND NORTH WESTERN RAILWAY.

LOCAL SERVICE TRAIN ON THE CHICAGO AND NORTH WESTERN RAILWAY.

which they may be used. The range in time of use extends from one day to an unlimited period, and, in the number of rides, from a single trip to as many trips as may be desired to be taken in one year.

CHARACTERISTICS OF SUBURBAN LINES AND PERMANENT WAY.

The range of practice in respect to the use of tracks for suburban trains is so varied, that the results have been tabulated in the following statement :—

	Number of railways.		Number of railways.
1 track	2	2 and 4 tracks..	5
2 tracks ..	11	2, 3 and 4 tracks	1
1 and 2 tracks	7	4 tracks ..	1
1, 2 and 3 tracks	1		—
1, 2 and 4 tracks	4	Total ..	32

Three railways report that a portion of their line is circular, around which trains are worked continuously ; upon the other twenty-nine railways trains are reversed for movement in each direction.

The gauge of the suburban tracks upon twenty-seven railways in the United States and Canada is 4 ft. 8½ in., measured between the inner faces of the heads of the rails, and is known as the standard gauge. Two railways in the United States report gauge of track as 4 ft. 9 in. In Argentina, one railway reports its gauge as 5 ft. 6 in., and in Brazil the gauge is reported by one railway as 5 ft. 3 in. In the United States no distinction is made in the rolling stock used upon railways having gauge of 4 ft. 8½ in. and those of 4 ft. 9 in. ; the gauge of the car wheels admitting of their use upon either gauge of track.

The distance from centre to centre of main track ranges on railroads of standard gauge (4 ft. 8½ in.) from a minimum of 11 ft. 6 in. to a maximum of 15 ft. In Argentina the distance is reported 13 ft. 9 in. with a track gauge of 5 ft. 6 in. ; and in Brazil 12 ft. 3 in., with a track gauge of 5 ft. 3 in.

SIGNALLING.

In the United Sttaes and Canada block signals are in general use upon the suburban lines of twenty-five railways ; only four railways in the United States, which have very light traffic, operate without the use of a block system.

The use of block signals for suburban traffic is also well established in Argentina and Brazil.

Of the block systems in use in the United States and Canada, fifteen are automatic, being operated either electrically or pneumatically ; six are manual ; three are combined automatic and manual ; and one railway uses an automatic system in combination with the electric staff.

In Argentina and Brazil, the manual block system is used.

STAFF.

As to the employees on suburban trains, it is found that for a minimum train service they consist of a crew of two men on the locomotive, the engineman and the fireman ; and a crew of two men on the cars, the conductor and the flagman, making a minimum crew of four men to each train. It is the general practice to confine the duties of the engine crew to the care and management of the locomotive, the engineman being especially charged with the movement and proper stopping of the train. The train crew is required to make collections of the tickets and fares, to assist passengers in getting on and off the cars, to preserve order and to perform such other duties as will ensure safe and proper service.

The conductor is chief in authority, and the other employees on the train are required to yield active obedience to his orders in the performance of their duties; although, in matters affecting the safe movement of the train, the engineman is upon many railways held equally responsible with the conductor.

METHOD OF WORKING.

Upon all the railways of America suburban trains are operated by steam locomotives. All the locomotives so used are simple engines, except that upon one railway in the United States (the Erie Railroad) and one in Argentina (the Buenos Aires, Rosario and Central Argentine Railway) a few compound locomotives are in service. The steam pressure of the simple engines ranges from 130 to 200 lb. with an average pressure of 160 lb. per square inch. The steam pressure used on the compound engines of the Erie Railroad is 180 lb. and upon the compound engines of the Buenos Aires, Rosario and Central Argentine Railway 170 lb. per square inch.

Bituminous coal is used for fuel on the locomotives of twenty-one railways; anthracite coal is used on nine railways, all of which are in the United States; coke is used on one railway, which is also in the United States. A few railways in the United States use successfully a mixed fuel consisting of bituminous and finely broken anthracite coal in about equal proportions.

The size of the cylinders of suburban locomotives varies greatly, the range for simple engines being from 14 in. diameter by 22 in. stroke to 20 in. diameter by 24 in. stroke.

The compound locomotives of the Erie Railroad have cylinders 12½ in. and 21 in. diameter by 22 in. stroke, and those of the Argentina Railway 16 in. and 23 in. diameter by 24 in. stroke. The suburban locomotives most recently built are simple engines with two large-sized cylinders and high steam pressure.

Locomotives with four driving wheels are generally used in suburban service, although most of the locomotives recently constructed have six drivers. The range of diameter is from 48 to 68 in., the average being 60 in.

The weight upon the driving wheels and the total weight of the locomotives in suburban service range are shown in the accompanying table

Locomotive.	Weight upon Driving Wheels.		Total Weight of Engine.	
	Minimum.	Maximum	Minimum.	Maximum
Loco. with four driving wheels	40,250 lb.	103,000 lb.	56,000 lb.	176,000 lb.
„ „ six „ „	83,000 lb.	128,000 lb.	125,000 lb.	210,000 lb.

Locomotives which are constructed especially for suburban service are generally designed to run at speed in either direction to avoid loss of time in turning at terminals. Sixteen railways have locomotives so constructed, while fourteen railways which use upon their suburban trains locomotives taken from ordinary service turn them at each end of the line.

None of the railways in America have adopted electrical working for suburban service, although one railway, the New York Central is now arranging for the installation of electrical equipment.

The automatic compressed air brake is in general use in suburban service in America with satisfactory results; two railways, however, report using the vacuum brake, also with good results.

ROLLING STOCK AND MAKE-UP OF TRAINS.

For the lighting of cars, fourteen railways use gas; nine use oil; six use oil and gas; two use gas and electricity; and one uses oil, gas and electricity.

All the railways in the United States, except one, and the railways of Canada, use steam from the locomotive for heating the cars. One railway in the State of California, and the railways of Argentina and Brazil, report that the climate does not require the heating of cars.

The type of passenger car generally used in suburban service of the railways of the United States and Canada has a central aisle with a door and platform at each end. The seats have capacity for two passengers, are placed transversly of the car on both sides of the aisle, and are reversible so that the passengers ride facing forwards. These cars are of wooden construction and are carried on two trucks of four wheels each. The average length over the end sills of the underframe is 53 ft., the average number of passengers seated is 64, and the total average weight of car empty is 61,000 lb.

(To be continued.)

OUR WEEKLY BIOGRAPHY.

MR. ERNEST KILBURN SCOTT, M.I.E.E., A.M.Inst.C.E.

MR. E. KILBURN SCOTT, who is well known to our readers as the contributor of "Power Station Notes" and "Electrical Affairs," has been appointed to organise and take charge of the electrical engineering department at the Sydney University, New South Wales. He is a native of Leeds, and comes of an old engineering family—the firm of R. Kilburn and Sons, still carrying on a textile machine-making business, founded over 100 years ago.

He entered his grandfather's firm in 1883, and afterwards went through the erecting and fitting shops, and drawing office of Messrs. John Fowler and Co. On the recommendation of Professor A. Barr, M.Inst.C.E., whose student he has been at the Yorkshire College, he became assistant to Mr. Wilson Hartnell, M.I.M.E., and assisted in steam-engine governor design and in the installation of many early electric lighting installations in the North of England.

MR. E. KILBURN SCOTT, M.I.E.E., A.M.INST.C.E.

In 1890 he was appointed head draughtsman to Messrs. Clarke, Chapman and Co., who were then manufacturing Parsons turbines, and to W. T. Goolden and Co., who carried out much pioneer electrical work in collieries.

After two and a half years as dynamo designer to the Brush Electrical Engineering Co., he was invited to take charge of the drawing office of the Electric Construction Company, Wolverhampton. He subsequently did some consulting work, sending out the original plant for the electric lighting of Coolgardie, working up the details of the South Staffordshire power scheme. He also inspected and tested boilers, engines, alternators, and other plant for Mr. Robert Hammond, M.Inst.C.E.

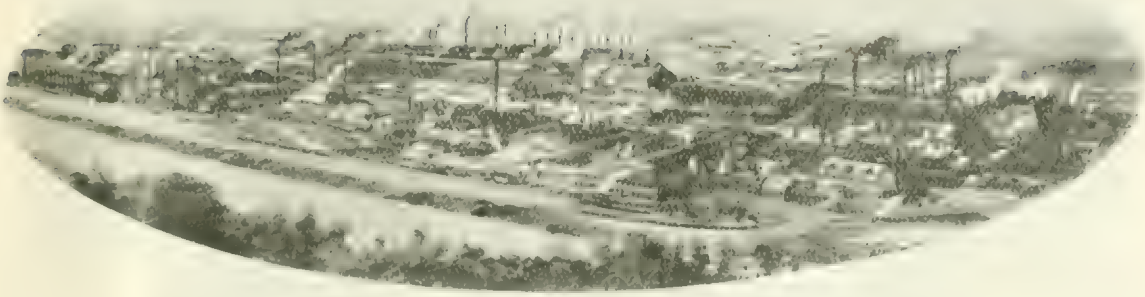
The next three years were spent with Messrs. Johnson and Phillips, where Mr. Scott was responsible for the estimating and technical correspondence, and worked on the details of multi-phase transmission plants for Burma Ruby Mines, Raub Gold Mines, Regendze Gold Mines, etc.

In 1900 he was appointed engineer and manager in this country for the Compagnie Internationale d'Electricité of Liege. He established a London office and sub-agencies and carried out many important contracts, amongst them the first three-phase municipal installation at Erith, and a large three-phase power plant at the British Xylonite Works.

Two years later he was asked by the owner of the Salem Magnesite, Mines in Southern India to carry out some original electric furnace work in Norway. He succeeded in producing a highly refractory furnace lining from Magnesite and first suggested its use as a furnace wash. He also reported on the value of the Meraker 3,000 h.p. calcium carbide factory, and carried out work there with a view to arriving at the exact cost of manufacture.

Of late years he has acted as advisory electrical engineer in connection with the Bath tramways scheme, the Sunderland and District Electric Tramways; also the three-phase 10,000 volts transmission scheme at Snowdon, and the narrow-gauge railways connected therewith, which are to be worked with alternate current.

He has been lecturer in Electrical Engineering at the Northampton Institute for five years. He is well known as a technical writer, and is the author of a work on the "Local Distribution of Power in Factories," and numerous papers in the Proceedings of Societies.



THE WORKS OF THE BETHLEHEM STEEL COMPANY

The works cover an area of about 175 acres. They include blast furnaces, puddling mills, Bessemer steel converters, rolling mills, open hearth furnaces, steam hammer and hydraulic forge press shops, machine shops, tempering and treating departments, etc.

STEEL FOR THE MANUFACTURE OF ARTILLERY.

By Lieut.-Colonel Cubillo (Spanish Royal Artillery).

II.

This article, continued from page 15, will be the more interesting to readers of Page's Weekly by reason of the notes which we published a year ago giving Lieut.-Colonel Cubillo's ideas on the reconstruction of the Spanish Navy.

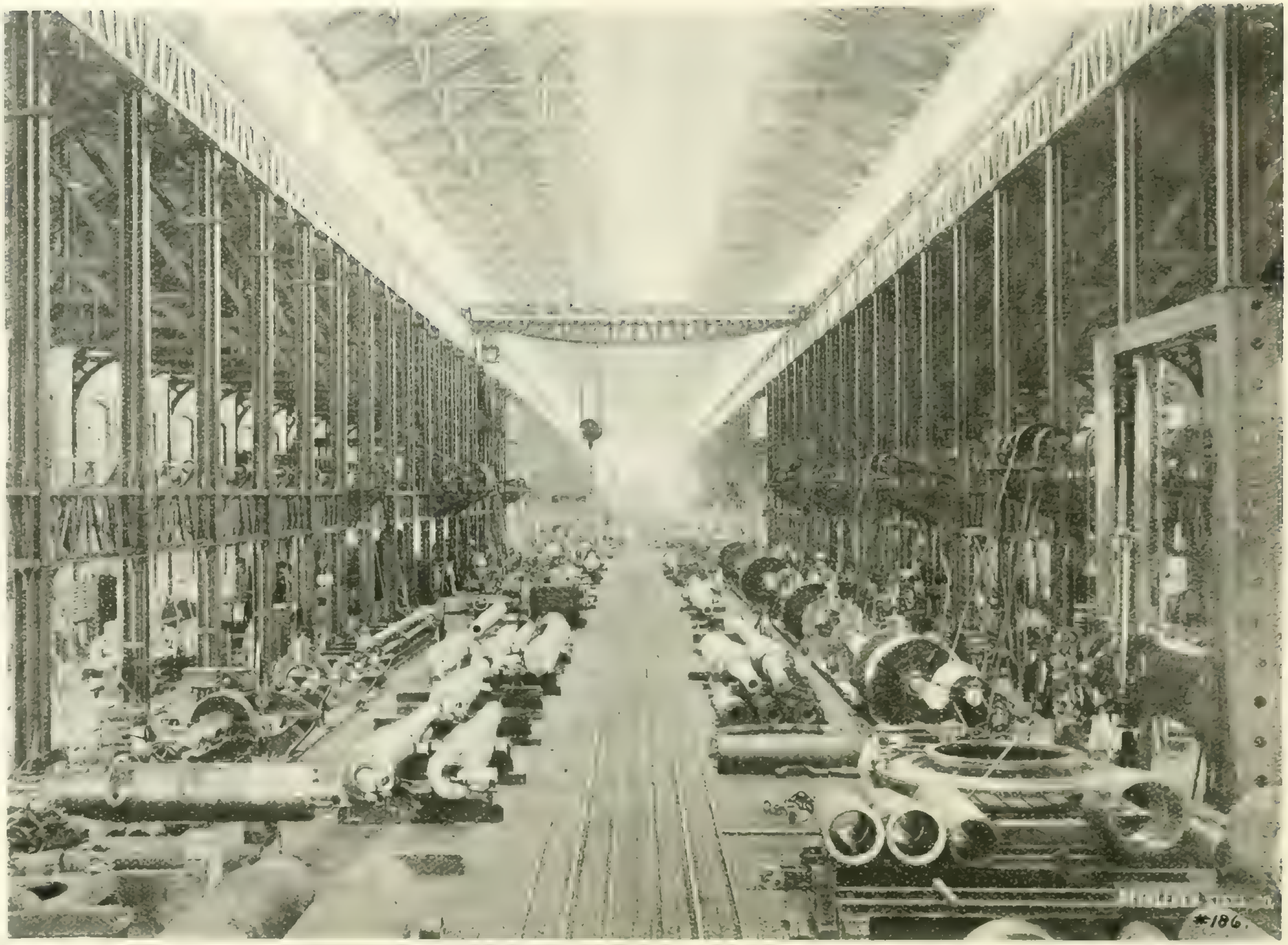
SOUTH BETHLEHEM is one of the greatest mechanical enterprises of the United States. It is an establishment similar to many in Europe devoted to the manufacture of war materials. Not in vain did John Fritz, the most eminent, perhaps, of all American metallurgists, remain at its head.

Without entering into a description of the furnaces and rolling mills, in this article, we will say that South Bethlehem, when the United States Government announced the idea of constructing a fleet and coast defences, offered its services to the Government without demanding subvention or even guaranteed contracts for a certain number of years. South Bethlehem risked more than any other company; Midvale began the manufacture of artillery materials; Homestead, armour plates; only Bethlehem installed a plant for the making of plates and complete guns. It is clear that anyone who attempts the manufacture of armour plates has more than sufficient plant for that of artillery materials, but South Bethlehem could say that they had erected two special installations, because, even if the Siemens' furnaces were common to both, the ingots used for the artillery material were treated by the fluid compression process, thus following the path and principles of Whitworth.

Money has not been stinted in South Bethlehem; everything relating to the preparation of first materials, furnaces and presses, is of the most modern type obtainable.

SIEMENS' PLANT

As in all new factories in America and those in Europe which follow the American system, the artillery parks are of ample proportions and are served by electric cranes. In these parks are prepared the charges for the Siemens'



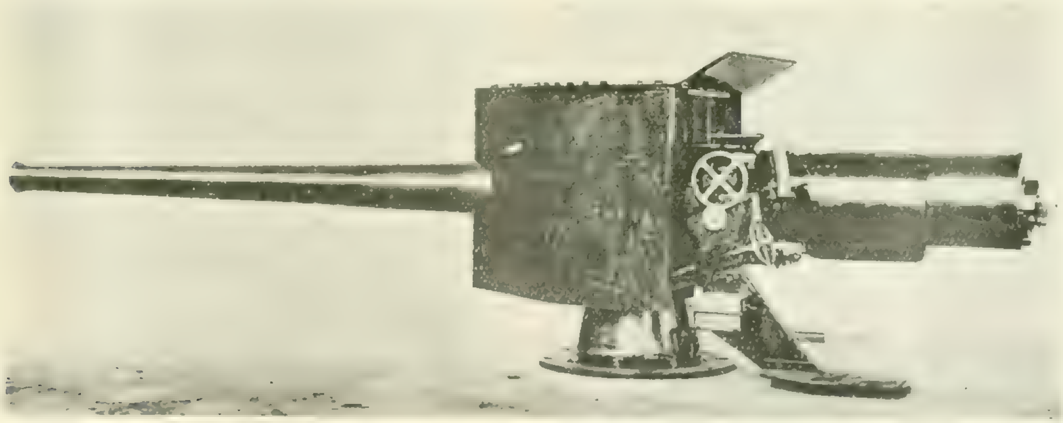
GUN FINISHING MACHINE SHOP OF THE BETHLEHEM STEEL COMPANY,

A sub-department of the general machine shop, which is the largest of the three machine shops in the Company's plant, being 1,460 ft. long and 117 ft. 6 in. wide. The gun finishing machine shop is equipped with the necessary machinery for finishing the parts of guns of all calibres, both before and after assembling, as well as their breech mechanisms. In this department the gun carriages and mounts are assembled and erected.

SHIPMENT BY THE BETHLEHEM STEEL COMPANY OF 600 TONS OF ARMOUR FOR THE IMPERIAL RUSSIAN BATTLESHIP "PETROPAVLOVSK."

The nickel steel plates are 16 in. thick, tapered to 8 in., and are 7 ft 8 in. high.

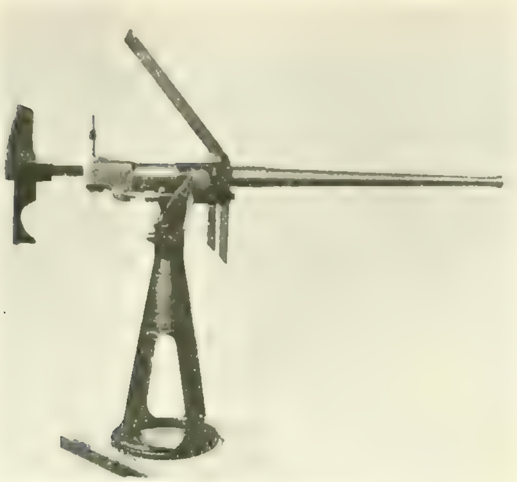
furnaces, as in Trubia, in iron boxes of 3,000-kilogramme capacity, which are transported to the furnace platform in narrow-gauge wagons, each of which carries three boxes. Once in position, and the furnace being ready to receive the load, a Wellman electric crane effects the charging. The Siemens' furnaces at South Bethlehem are of great capacity and placed in a line with the casting pits in front. The fusion and refining of the loads are conducted in the usual manner; the amount of carbon, in conformity with the stipulated conditions for artillery steel is 0·45 per cent. In its application of the Whitworth process, South Bethlehem compresses the fluid steel in a press of 7,000 tons; one of the most powerful yet constructed. It is enough to say that the upper part weighs 120 tons, the lower 135 tons, and that the steel columns are 15 metres in length and 480 millimetres in diameter.



THE COMPANY'S 6-IN. 50-CAL. RAPID-FIRE GUN AND MOUNT WITH MINIMUM PORT SHIELD.

The shield is rigidly attached to the cradle of the mount and is carried with the gun as the piece is elevated or depressed. The shield plates are of Krupp armour, and can withstand the attack of 6-in. armour-piercing projectiles. The shield offers a maximum protection to the gun's crew without materially increasing the effort required in elevating and training the gun.

EXAMPLES OF GUNS DESIGNED AND BUILT BY THE BETHLEHEM STEEL COMPANY.

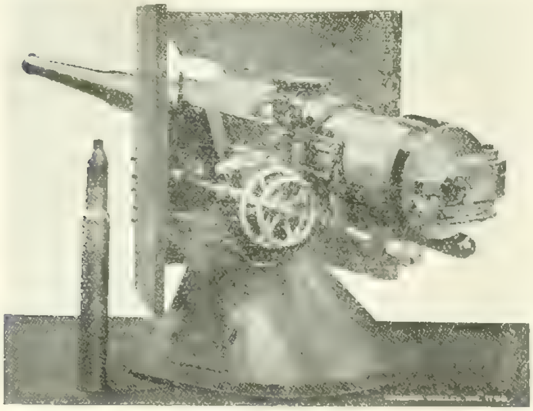


1-POUNDER SEMI-AUTOMATIC GUN AND MOUNT.

There are two presses used for the forging of artillery material, one of 2,500 tons, the other of 5,000.

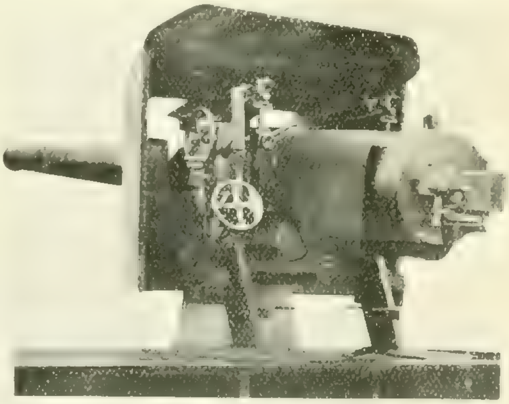
FORGING A 40-CENTIMETRE GUN.

The possession of these powerful instruments enabled the South Bethlehem Works to undertake the making of the material for a 40-centimetre gun for the Watervliet Arsenal; the ingots smelted for the interior tube of this piece weighed more than 100,000 kilogrammes, and the 5,000-ton press was required to forge it. It was of nickel steel, and after the forging it was reheated, a convenient operation to obtain a uniform condition in the entire mass of metal. The hardening of the pieces is done in a workshop completely covered and closed on all sides, an arrangement which has advantages for the observation of the different temperatures at a glance, and protects the mass from currents of air which might chill certain parts of the tubes during the time they pass from the furnace to the oil bath. The gas furnace in which the tubes and sleeves are heated at South Bethlehem are completely buried, the mouth being level with the floor close to the oil tank. The tubes are again annealed which leaves the metal in the most perfect condition, correcting any prejudicial tensions to resistance which may have happened in the hardening.



4-IN. 50-CAL. GUN ON PEDESTAL MOUNT.

The gun is equipped with telescopic and night sights, and with electric and percussion pull-off firing gear



6-IN. 45-CAL. RAPID-FIRE GUN ON PEDESTAL MOUNT.

The gun is equipped on both sides with telescopic and open sights, with night attachments, and can be trained from either side. The gun fires loose ammunition, with powder charge in brass cartridge case, and has electric and alternate percussion firing gear.

GUN FINISHING MACHINE SHOP.

The workshop for the machining of artillery material and the finishing of the parts is superb: it is sufficient to say that it is 420 metres in length and 35 metres in width. Served by electric cranes, it contains the most powerful and the most delicate machines, from the lathes and boring machines capable of receiving the inner tube of a 40-centimetre gun to the smallest machines for the manufacture of minute screws. Boring, rifling, chambering, screwing and sectioning machines, lathes from the great factories of the Niles-Bement-Pond Company, and some others, in great number, using the most perfect modern tools, fill this great space. A new workshop will shortly be added for the adjustment of breeches, and will complete this splendid plant, which, at present, is in charge of Mr. Meigs, a retired naval lieutenant, well known by his work on Ballistics, and as the inventor of a breech possessing manifest advantages over that known as the Velin.

South Bethlehem, like the firms of Vickers-Maxim, Armstrong-Whitworth, and others, not only manufacture tubes, sleeves, hoops and guns, but also carry on original experiments in field and coast defence artillery.

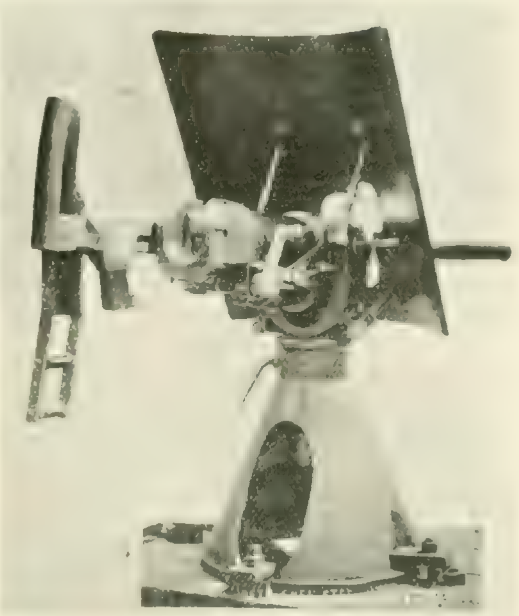
NEW GUNS.

The Artillery and Fortification Committee are at present proving two rapid-fire guns of 5 in. and 6 in., made by this firm, the first mounted to combine the properties of a disappearing carriage and rapid fire. The results of the tests with this gun are unknown; the 6-in. rapid-fire gun must have an initial velocity of 915 metres and throw a projectile weighing 45 kilogrammes. The rapidity of fire has been fixed at eight discharges per minute. The pressure has not been determined, but the contract stipulates that it must not be excessive.

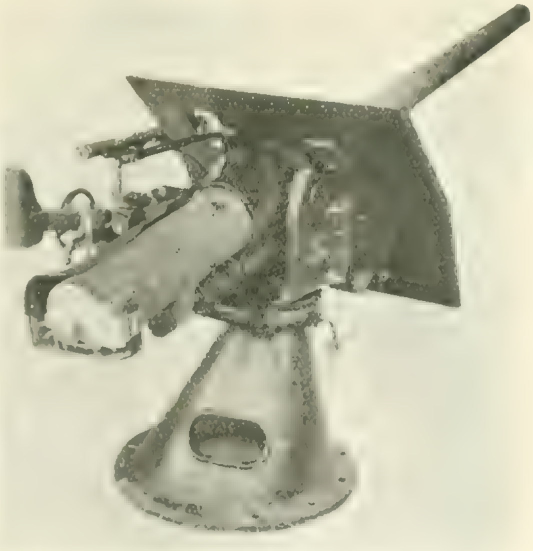
These are not the only contracts made by the South Bethlehem Company with the U.S.A.; by a deed signed on the 7th November, 1901, the Company arranged to deliver, completely finished, one hundred coast-defence guns, as follows: twenty-five of 8 in., fifty of 10 in., and twenty-five of 12 in.

South Bethlehem has delivered to the national factory at Watervliet the forged and tempered

FURTHER EXAMPLES OF THE BETHLEHEM STEEL COMPANY'S GUNS.

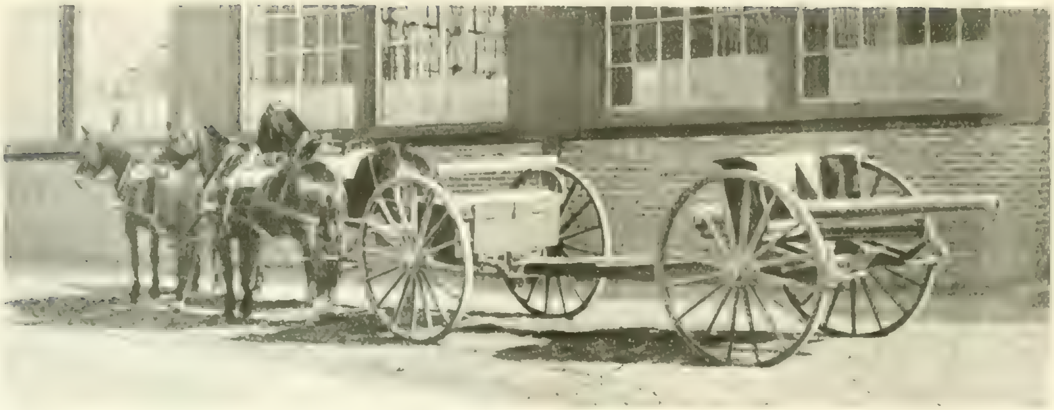


6-POUNDER SEMI-AUTOMATIC GUN AND MOUNT.



3 IN. 15-POUNDER RAPID-FIRE GUN ON PEDESTAL MOUNT.

The gun is equipped with telescopic and open sights, electric night sights and electric and percussion pull-off firing gear, and has hand gear for elevation and traverse on the mount.



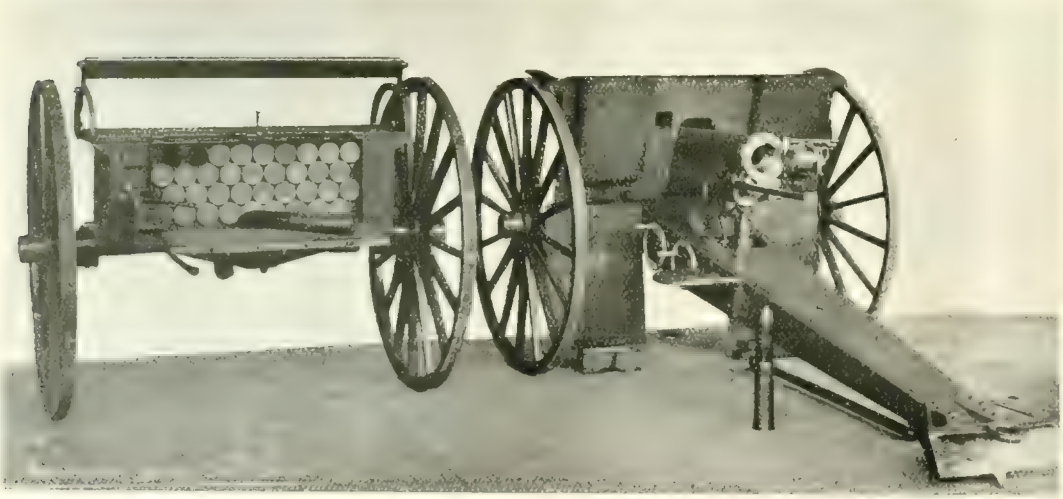
3-IN. HORSE ARTILLERY GUN, LONG RECOIL CARRIAGE AND LIMBER.

steel intended for tubes, the sleeves, hoops and accessories of other pieces detailed below :—

		lb.
71	for 6-in. Guns ...	188,514
33	„ 10-in. „	300,826
55	„ 12-in. „	861,612
2	forged pieces for 12-in. Howitzers	1,000
3	„ „ „ 12-in. Guns ...	16,000
570	Ingots for forged pieces	239,000
		1,606,052
		or 728,040 kilogrammes

GUN TESTS AT SANDY HOOK.

As a question relating to the qualities of metal for the construction of pieces of artillery, I must speak of the experiments with a 15-centimetre gun made of simple cast steel, which have recently taken place at Sandy Hook. On January 19th, 1898, the Artillery and Fortification Committee placed an order with the Aktiebolaget Bofors Gullspang, of Bofors, Sweden, for the manufacture of a 15-centimetre



3-IN. FIELD GUN, LONG RECOIL CARRIAGE AND LIMBER, ALSO DESIGNED AND BUILT BY THE BETHLEHEM STEEL COMPANY.

The gun fires from seat on left side of trail, or by lanyard, and is provided with telescopic sight. The gunner is protected from rifle and shrapnel fire by shield on carriage.

rapid-fire gun, with pedestal carriage and one hundred rounds of ammunition. The price was $15,417, and one year was given for delivery. As usually happens the time for delivery was exceeded, and the gun was not received at the proving ground until July, 1901, and, owing to difficulties encountered in mounting, it could not be tested until March, 1902. Owing to the excessive amount of work pressing on the Experimental Committee the tests of this gun have proceeded very slowly; at the time of my visit to the United States it had been discharged 250 times. The gun is composed of three parts: barrel, sleeve, and breech. The projectile weighs 45 kilogrammes, with a velocity of 800 metres.

The screw opens and closes by one movement automatically, or by hand, as desired. The lodging of the lock is of conical form, with a large opening for the charge, and is provided with a tile of automatic action. The carriage is provided with two gears on both sides, so placed that one man attends to the elevation and another to the direction of fire. In the tests of rapidity of fire, ten shots have been discharged in 103 minutes when managed by hand, and the same number in 94·6 minutes when the screw has been opened and closed automatically. This automatic mechanism is perfect. It opens on the return of the gun to its cradle; in the return a spring is compressed and a kind of picklock holds it open. When the picklock is released the spring closes automatically. The working of this mechanism has been excellent during the tests. It is seen, by the results of the rapidity of fire tests, that the automatic lock does not possess any great advantages, but it economises space for the charge and requires one man less to handle the gun. As I have not been allowed to see this gun—no foreign officer being permitted to visit Sandy Hook—I have obtained the foregoing details from a paper by Commander Rogers Birnie, of the Fort Monroe School of Artillery, and if I am unable to give more details regarding this interesting gun, I may be allowed to make some observations upon the metal of which it is constructed. For many years the artillery factory of Bofors has applied cast steel to the making of guns, and it bases its studies on the well-known property of steel, by which it acquires all the physical qualities from its chemical composition, exclusively, by calorific treatment (hardening and reheating) and with a total independence of the intervention of hammers or presses.

When a bar is subjected to a hammer press or rolling mill, the forging, or rolling, fills two functions; the first, the principal and most important, is to impede the crystallisation of the heated metal, as would be the case if the blows of the hammer did not prevent it, a state of repose being necessary to crystallisation; the second, of less importance, is the shaping of the bar. The first operation, which gives the maximum tenacity and ductility to steel, is more easily and rapidly performed by hardening and reheating than by the slower process of forging.

Having described the methods employed in the Midvale and South Bethlehem factories, which alone supply the national workshops, we see that they do not differ from those used in Europe; there is no great progress to chronicle, the same quality of steel, obtained from raw materials of the same degree of purity, and an identical series of operations forming the total process of manufacture of the tube or sleeve. Touching the quality of the metal, carbonised or nickel, it appears impossible to improve it, or to obtain mechanical qualities superior to those of to-day.

(To be continued.)

QUESTIONS OF THE DAY.

The National Encouragement of the British Inventor: How can it be secured? *(Continued from page 34.)*

THE CHARACTER OF THE PATENT OFFICE EXAMINING STAFF.

In the discussion on Mr. Abel's paper, dealt with in the last issue, Mr Oscar Guttman made the following observations :—

An objection was with regard to the quality of the examiners. He happened to know the quality of the junior examiners in Germany, and also knew the standard for the assistant examiners who were selected in this country for positions under the new patent law. He was afraid the Germans would come out better in that respect, but he did not wish to discourage the young men who would be assistant examiners; probably in a year or two they would have greater experience than they at present possessed. In Germany an assistant examiner must have been at some works and had some practical experience, or he must have undergone a course of very severe study. In this country assistant examiners were chosen, not according to the record of their study or work, but by means of the wonderful competitive examinations which existed in England, where generally not the clever men were at the top but those who went through an examination best, and it was well-known what a curse the examination system had been in this country in all sorts of professions.

THE COMPULSORY PUBLICATION IN THE PRINTED SPECIFICATION OF ANTICIPATIONS ARBITRARILY DEFINED BY THE PATENT OFFICE.

Sir Lloyd Wise in his contribution to the discussion on Mr. Abel's paper, observed :—

In the interest of inventors, I desire, if in order, to direct special attention to the new patent rules, which seem to me highly objectionable.

In my opinion they point to about the most obnoxious method that could possibly have been devised of carrying out the provisions of Section 1 of the Patents Act of 1902. This is the more unfortunate because effect might readily be given to those provisions in a manner that would prove advantageous both to inventors and the public.

I suggest, in particular, that the utmost possible pressure should be promptly brought to bear with the view of getting the rules so far modified that in carrying out Section 1 of the Patents Act, 1902, the special forms of reference to prior patents set out in Rule 10 of the Patents Rules, 1905, shall apply only in cases where the applicant has not already mentioned the prior patent in his specification, and has been duly notified of the Comptroller's determination that a reference to a prior specification ought to be made, and has failed to embody in his own specification, in his own way and within a specified reasonable time, a reference by number, year, and name to such prior specification.

According to the new rule 10, if the applicant once goes the length of troubling the Comptroller to determine whether reference ought to be made in the applicant's specification to any, and if so, what, prior specification or specifications by way of notice to the public; then, should the Comptroller's decision be affirmative, an official notice is to be placed upon the unfortunate applicant's specification in these terms :—

"Reference has been directed, in pursuance of Section 1, Sub-section 6, of the Patents Act, 1902, to the following specification of Letters Patent, No. ....granted to......................"

Where the reference is inserted as the result of a provisional report, under Rule 7, a statement to that effect is to be added to the reference.

Surely an applicant should be allowed to take a patent at his own risk, provided he (himself) specifically mentions the prior patent or patents, reference to which is regarded as necessary for the protection of the public. The mention thereof by No., year, and name, would obviously be a notice to the public, inasmuch as his specification is addressed to the public. Why, then, should it be in any way made known, to his prejudice, that he referred to the prior patent under compulsion? The contemplated practice will be tantamount to publication of an official report to the effect that, in the opinion of the Comptroller, the patent is invalid.

What justification can there be for thus handicapping inventors whom the patent laws are intended to encourage? *Why not give the patentee absolutely fair play?*

If the framers of the Act had contemplated the sort of practice seemingly intended to be set up, surely they would not have expressly prohibited, as they did in the Act, publication of reports of examiners, which, as a matter of fact, formed an essential part of the original scheme as approved by the Society of Arts, after full discussion, in 1877, and submitted by me, as the Society's delegate, to the International Congress at Paris in 1878.

MASTER CAR BUILDERS' DROP-TESTING MACHINE,

Installed at Purdue University.

By William F. M. Goss,

Dean of the Purdue Schools of Engineering and Director of the Engineering Laboratory.

At its annual meeting in 1898, the Master Car Builders' Association appointed a committee to define fully the contour lines of couplers, and to propose specifications which might guide railway companies. The report which it presented at the next annual meeting, recommended, among other things, that couplers offered to railways be subjected to a series of tests under a drop-testing machine. The committee not only defined the nature of these tests, but presented a design for a machine to be employed in carrying them out, and the present Master Car Builders' drop-testing machine was the outcome of its work.

The value of a drop-testing machine having become apparent, it was determined that the Association should provide itself with a perfected machine, and that the machine should not be in the keeping of a railway company, but should be established upon neutral ground. Since the air-brake testing rack and the brake-shoe testing machine of the Association had already been installed in the laboratories of Purdue University, the location for the proposed machine was easily chosen.

DESCRIPTION OF THE MACHIN

General elevations, sections, and a plan are shown in fig. 1. It will be seen that the machine rests upon a foundation of concrete above which it rises to a height of more than fifty-four feet. The anvil (A) is in the form

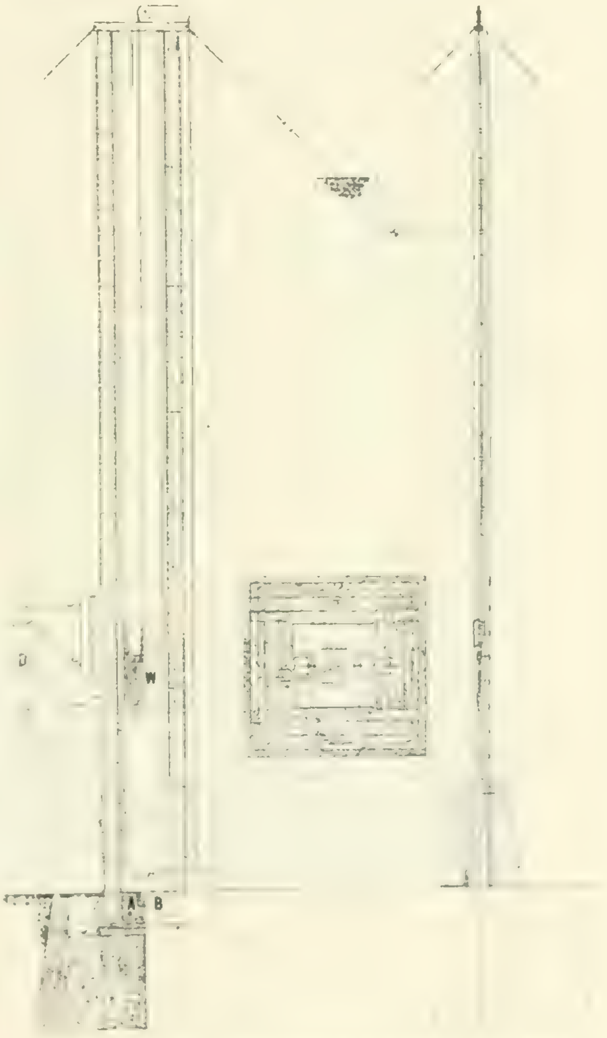


FIG. 1. GENERAL ELEVATIONS, SECTIONS, AND PLAN.

of a rectangular casting weighing 17,000 lb. For convenience in holding a coupler, as will hereafter be explained, it has in the middle an annealed steel insert (B). The anvil is carried by nests of coiled springs, which in turn bear upon a suitable foundation plate. The spring support of the anvil is intended to make the machine easily reproducible. It is assumed that the resisting qualities of an anvil thus supported will be the same whether the machine itself rests upon a rock foundation or upon soft soil.

The drop of the present machine, weighing 1,640 lb. is of forged steel and is shown in detail by fig. 2. This weight meets the requirements of the Master Car Builders' specifications for coupler testing as well as those of the International Association for Testing Materials, with reference to axle testing, and is made to meet the requirements of the specifications of the last-named Association for rail testing by fitting discs to the cylindrical opening in such a manner as to increase its weight to 2,000 lb. The drop is handled by a wire cable served by a small reversible hoisting engine (not shown in the drawings). The traveller above the drop carries a tripping mechanism so arranged that when a stop is set the drop is released from any predetermined height.

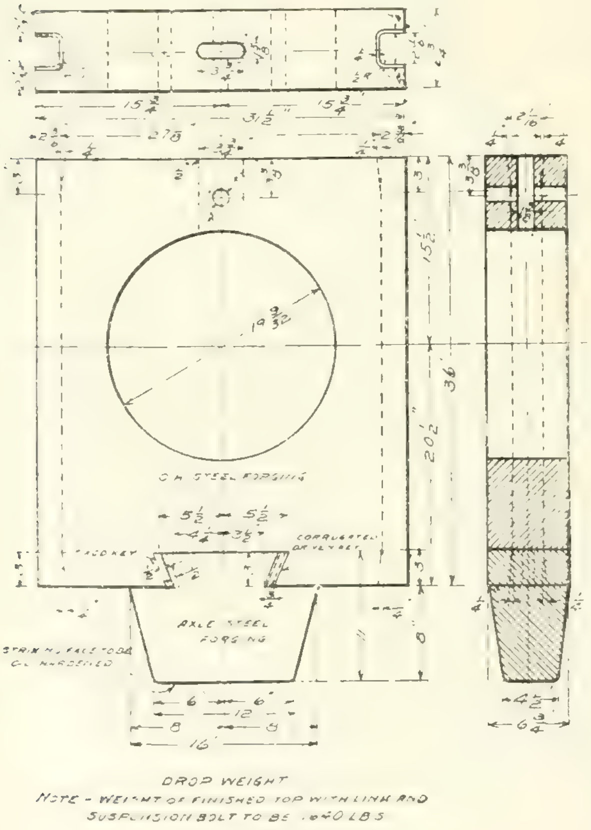


FIG. 2. DETAILS OF DROP WEIGHT.

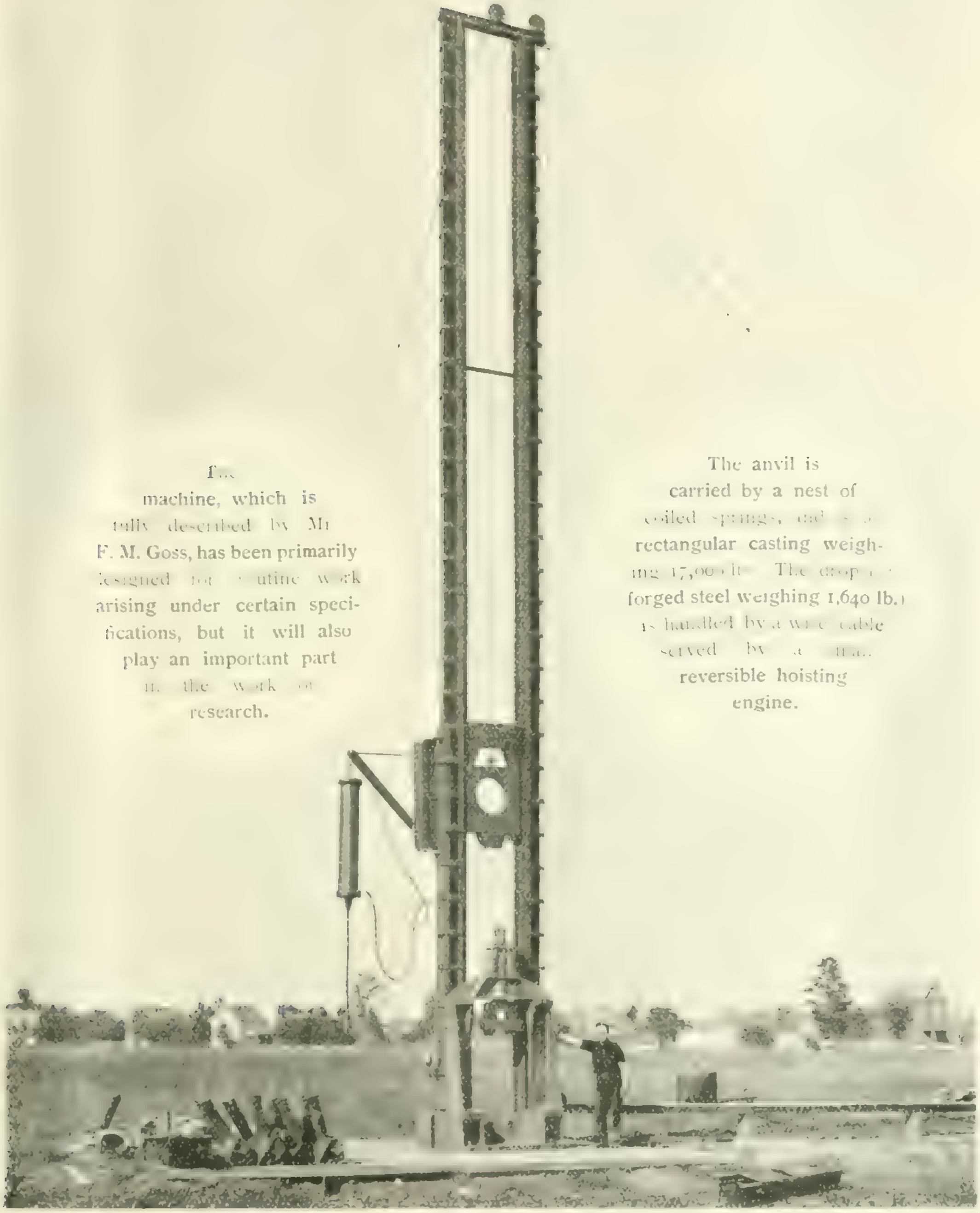
The vertical guides are shown in enlarged section by fig. 3. Each guide is made up of three rolled shapes, namely, a rail section, a channel, and an eye-beam, to which at intervals is added a curved brace to serve as a ladder. The height of the guides makes it necessary to have them guyed from the top as shown by fig. 1. Their lower portions are reinforced by cast-steel housing.

An air-hoist (D, fig. 1) serves in handling accessory equipment and the materials to be tested. The hoist is carried by a double-hinged crane in such a manner that it may be swung around to the centre line of the machine from either side. This is best shown in the plan (fig. 1).

TESTING UNDER THE DROP

To test either the guard-arm or the knuckle of a coupler under buffing strains, the shank of the coupler is dropped into the steel-lined pocket (B) of the anvil, and the body of the coupler is wedged into position under the drop by means of steel liners supplied for that purpose. Thus prepared, the Master Car Builders' specifications require that the couplers shall withstand three blows from a height of five feet and three blows from a height of ten feet, delivered either upon the closed knuckle or upon the guardarm, without producing distortion beyond stated limits.

A tension ("jerk") test of couplers involves additional equipment, as shown upon a large scale by fig. 4. In this case the coupler is fitted to a suitable yoke (F) which in turn is



The machine, which is fully described by Mr. F. M. Goss, has been primarily designed for routine work arising under certain specifications, but it will also play an important part in the work of research.

The anvil is carried by a nest of coiled springs, and is a rectangular casting weighing 17,000 lb. The drop (of forged steel weighing 1,640 lb.) is handled by a wire cable served by a small reversible hoisting engine.

MASTER CAR BUILDERS' DROP TESTING MACHINE.
Installed at Purdue University.

carried by springs performing the same function on the machine that is performed by the draft rigging on a car, the whole being suspended from a cross-girder surmounting two cast-steel columns. In the original machine two couplers were employed in this test, a suitably formed equaliser (E) extending between the couplers and receiving the blow from the drop. The left-hand elevation (fig. 1) shows the columns on either side of the machine necessary to carry the two couplers referred to. In the present machine, however, the necessity for using two couplers has been avoided by having one end of the equaliser carried by a support (fig. 4) beneath which are springs of the same character with those which carry the yoke on the other side. It is believed that in this manner the jerk test of couplers has been simplified and that for comparative purposes its value has not been diminished. The yoke F is designed to receive coupler shanks of different dimensions by an opening sufficiently large to admit filling pieces, designed for the several different-sized shanks.

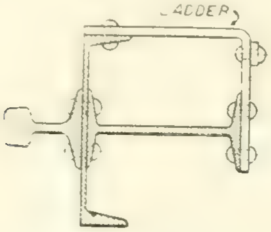


FIG. 3. SECTION OF VERTICAL GUIDES.

Draft-gears for test under the drop are fitted to short lengths of draft sills, the ends of which may rest directly upon the anvil of the machine. In the place of the usual yoke and coupler, dummy construction is employed which will give a shank reaching out between the draft sills in such a manner as to receive the blow of the drop. Tension tests of draft gears by use of this machine are not contemplated.

For axle testing there are provided two supports which may be placed upon the anvil on either side of the centre line of the machine to receive the axle, which, when thus placed, may receive blows from the drop in the middle of its length. Similar equipment serves in rail testing.

THE MACHINE AS A MEDIUM FOR RESEARCH.

The Master Car Builders' drop-testing machine has been brought into existence to serve chiefly in routine work arising under certain specifications of the Association. There is, however, no reason why it may not also serve in work of engineering research. In view of the important studies of a highly scientific character concerning the behaviour of constructive materials under impact, which have already been made by the aid of lighter machines, it is but reasonable to expect that a heavy, well-designed drop such as has been described will serve in extending the limits of such inquiries. In so far as the machine may serve such purposes it will fill an ever-increasing field of usefulness.

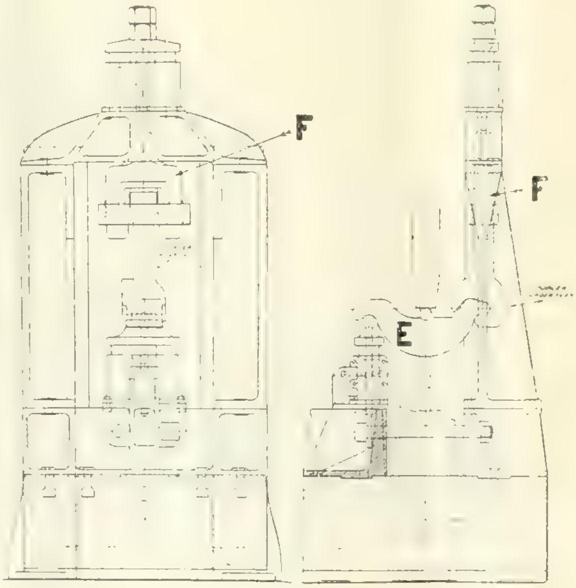


FIG. 4. EQUIPMENT FOR TENSION TESTS.

THE GAS ENGINE AND STEAM TURBINE IN HARNESS.

By B. H. Thwaite, C.E.

THE economic supremacy of the principle of centralisation in modern work of power-energy development, and the distribution and transmission of such power electrically, is now proved beyond cavil. We have had for many years evidence of the economic effect of concentration in the high-power ocean steam-ship plants, and engineers only awaited the advent of an economic method of transmission of power to accept the economics of the principle of centralisation on land.

THE PRIME MOVERS OF THE FUTURE.

We have already evidence of the economy of the system of concentration in County-electro-power plants, instance that of Newcastle and district; and we have through the Mersey Electric Railway results, additional evidence to that already accumulated in favour of the displacement of the small-power railway locomotives, by the system of centralised power production, and its electrical distribution. There is little question but that we are on the eve of a great revolution in railway transport methods, and this may mean the electrification of even our great trunk-railways. Now the margin of possible improvement in the modern electrical machinery of transformation and distribution has been gradually narrowed down, but there is still ample margin for improvement in the choice of the instruments of motive or dynamic energy production, and the battle of the future against inefficiency will probably be more or less localised within the area allotted to the reduction of the thermodynamic inefficiency of our prime movers. The struggle will probably [illegible] the gas engine as the solution of thermal efficiency, and the other putting forward the advantages of the steam turbine.

It may here be mentioned as a peculiar historic coincidence, that the engine by which the author obtained the thermal results that led to the harnessing of the blast furnace to the gas engine, and as a sequential incident, the creation of the high-power gas engine, was built at the works from which the Parsons turbine was launched into the commercial world.*

GAS ENGINE *V.* TURBINE.

Now the adherents to the cause of the gas engine make the following incontestable claims:—

A proved thermal efficiency on every-day work of some 30 per cent.

The economic facility for recovering the nitrogen and tarry compounds from the fuel.

Low water consumption.

Less liability to dangerous explosions than is associated with steam boiler installations.

Less labour requirements.

A possible mechanical efficiency of 85–90 per cent. with balanced-effort vertical types of engines.

A possible running regularity with multiple vertically-arranged cylinders that will satisfy the cyclical exigencies of polyphasic and parallel-running electrical machinery.

The adherents to the cause of the steam turbine claim—first, an almost perfect cyclical regularity, and one that is unapproachable with a reciprocating engine, however well balanced it may be; secondly, a higher power of output ratio to weight of machinery; thirdly, self-starter. The adherents to both power systems will secure victories. In Germany, for example, we find that the Frankfort Electrical Station is equipped with steam turbines of high power, whereas in other parts of that country very high-power capacity gas engines are in regular use, and to-day many are endeavouring to embody the cyclical advantages of the steam turbine with the thermal efficiency of the reciprocating gas engine in a new machine. Unfortunately, it is possible that the active workers in this new development are overlooking the great fact explaining the high-power gas engine success—the reliance which can be placed on mechanical, and of course controllable means to secure such a density of a gaseous explosive mixture (constituted of gas of low calorific value of only some 80 to 100 B.Th.U. per cubic foot) as will ignite with the rapidity necessary to satisfy the high reciprocation of gas engine practice, and this without danger of pre-ignition during the active period of compression. Of course such a gas is almost incapable of ignition at normal atmospheric pressures, and consequently requires a compression application of some four to six atmospheres to make it adequately sensitive to ignition influences. In modern practice the tendency is even towards higher and higher degrees of compression. This high-compression stage is the secret of the thermal success of the Otto cycle, and it is this feature that will constitute the difficulty in producing a thermally efficient and commercially satisfactory gas turbine, because if high thermal economy is to be attained there must be no unavoidable dissipation of thermal energy in compression effort.

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* The [illegible] Messrs. [illegible] Chapman [illegible]

CONDITIONS INIMICAL TO A GAS TURBINE.

The minimum loss in the compressional stage is secured in the ordinary Otto cycle because the compression work is effected in the power-developing cylinder. That this effort involves the minimum degree of loss can be readily ascertained in any well-constructed engine employing high degrees of compression. It will be found that the curve line of compression and that of re-expansion are almost line on line, that of expansion on the return stroke being only slightly below that of the line of compression, representing on the card area probably at the most only a few percentages of dissipated energy. Anyone who has studied the technics of compression realises the considerable loss in the flow of the compressed fluid through contracted areas such as the ports and other connections of the compression cylinder, *i.e.*, when the expansion is effected in a secondary cylinder, so that unless such compensation in the nature of higher-power potential ratios to weight of actuating organs can be obtained as will justify the loss of energy in compression work, it will be found to be irrational to deviate from the ordinary Otto reciprocating cycle, and it is therefore very probable that the high-compression stage efficiency provided by the Otto cycle will prevent the displacement of this latter reciprocating cycle by the turbine gas engine, or even by the engines of the two-cycle principles or in which compression and expansion are effected in two distinctive cylinders.

No turbine air compressors working at variable speeds are likely to give such a sustained return of power energy as is given by the reciprocating Otto cycle engine, and without this high initial compressional stage the turbine as representing a thermally economic principle will be unavailable, at least for using the ideal power-gas of the future, or one in which carbon monoxide is the supreme agent of heat production, and in the use of which a high degree of compression is necessary to secure a sufficiently sensitive ignition. If a turbine gas engine is to be economic, its fuel agent must be a gas that will be ignitably sensitive with comparatively low degrees of pre-compression, such as is oil vapour or a gas rich in hydrocarbons; but then this condition brings with it the difficulty of a higher range of temperature in the working cylinder, and the danger of the overheating of the actuating organs of the engine.

PROPOSED DUAL COMBINATION OF GAS ENGINE AND STEAM TURBINE.

But if we admit that the practical construction of a thermally economic gas turbine appears to be almost unattainable, there is surely no reason why the two power-producing agents—the gas engine and the steam turbine—should not work in harness together. Some years have passed since Mr. Dugald Clerk and the author jointly considered it to be practicable to build a 1,000 h.p. gas engine for marine purposes; since then, very great progress has been made in the construction of internal-combustion reciprocating engines of high power. If one were asked to formulate a proposition for a power plant of high-power capacity, especially for marine applications, but applicable for land services, it would certainly include a programme of interdependence, in which the power creators would be a gas engine and a steam turbine. And why? Because in the gasification of the fuel, and in its preparation for the gas engine, it is primarily essential that the gas shall be cooled to the temperature of the atmosphere, and the loss of the sensible heat this temperature reduction involves, might be prevented if part of the gaseous fuel were employed for generating steam, the combustion of the gaseous fuel being effected in the steam boiler furnace with air heated by being drawn through the gas tubular cooling apparatus. Moreover, it is essential that the working cylinders of the (Otto cycle) gas engine and some of the actuating organs should be kept cool, an operation involving a considerable loss of thermal energy, even as much as that thermo-dynamically utilised. Now, a great proportion of this thermal waste could be avoided if an auxiliary steam generator were made part of the power equipment. Besides, the exhaust gases of the gas engine are available as an additional source of heat supply. The steam thus generated would be available for driving a steam turbine, so that the two types of power-generating machines would be acting in inter-dependent connection for a common service. The absolutely perfect combustion of the gaseous fuel in the working cylinder of the gas engine would provide a great part of the thermal potential required for driving the steam turbine; the gasification process and the gas engine exhaust stages would be drawn upon to secure part of the balance of heat, the remaining thermal requirement being satisfied by direct combustion of the gaseous fuel in the steam boiler furnace.

The steam turbine and its steam-generating accessories would provide an independent auxiliary plant to serve as the starting equipment for the vertical gas engine, and the reversal motion requirements would also be obtainable from such an elastic combination. The operating programme of such an interdependent turbine and gas-engine equipment will be made up as follows: The rapid starting of the gasification process with fan propeller, driven with steam initially generated with solid fuel to be subsequently displaced with gas; the starting of the high-power vertical gas engines with the steam turbine; the reversal of the gas engines by the steam turbine, which will, of course, be compounded and equipped with condensers; the proportion of the gasification product required to be used in the steam generator will be small because of the thermal assistance given by the gas engine, hot jacket water, etc.

The proposed dual combination of prime movers would give the following advantages to ocean steamships:—

First, it would reduce the thermal loss by at least* $\frac{15}{38}$ by ·100=40 per cent., without allowing for the heat saved by the utilisation of the hot jacket water, which might secure a further saving of 15 per cent. making up a total thermal saving of 55 per cent. on the best existing marine engine practice.

THE COMBINATION AS AFFECTING BATTLESHIPS.

The other advantages [illegible] would mean a lessened consumption of water. The tell-tale trail of smoke issuing from the funnels of steamships would practically disappear, adding thus to the comfort and cleanliness of the ship, besides reducing the danger in war time of capture by the enemies or by privateering vessels. The advantages would be extended, if the propositions were applied to a battle-ship, by other features of strategic value. For instance, during an engagement the steam-generating plant could be shut down altogether, and there would be no danger of self-destruction should the steam boilers be pierced with shot or shell. The trail of smoke and its indication of the vessel's movements would be absent, and the piercing of the funnels (of small proportion compared to those of existing practice) would not interfere with the efficiency of the gas engines. The fuel would be fed into the high-pressure gas generators automatically, so that the stokers' work in the boiler stoke-hole of a battle-ship would be deprived of its terrors, and, owing to the reduction in weight of fuel required for a given power, the storage space would represent a more extended running power. A like proposition for inland services would permit smokeless power to be obtained, and with bituminous fuel, the recovery of the condensable hydrocarbon and nitrogen as well, the programme of operations need involve only a very temporary service of solid fuel.

For the purpose of securing mechanical efficiency, the more closely the line of the curve of power developed by combustion in the cylinder of the gas engine correlates with the effective crank-turning moment line, the higher is the attainment of mechanical efficiency. A violent development of power almost on the line of the dead-crank centre is inimical to the mechanical and sustained working efficiency of the gas engine. The completeness of the diagnosis of the efficiency of a gas engine is limited by the character of our testing instruments of precision, and until the question of the variability of the specific heat with rise of temperature as the explanaion of the limitation of temperature of gaseous combustion is either accepted or disproved, and until an instrument as reliable as a modern pressure indicator can be found to directly determine temperature variations during the acting stroke of a gas engine, it is impossible, with any practical advantage, to discuss what is termed the entropy character of a gas engine.

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* [illegible]

THE UNDERTYPE ENGINE.

BY J. C. R. ADAMS.

(Continued from page 32.

The present series, which is now concluded, commenced in PAGE'S WEEKLY for December 23rd. Previous articles on Portable Engines, by the same author, appeared in the July-October numbers of PAGE'S MAGAZINE.

MESSRS. CLAYTON AND SHUTTLEWORTH, LTD., of Lincoln, show, in fig. 11, one of their latest and most up-to-date designs in the way of compound undertype engines for working at 150 lb. boiler pressure. We have again the almost universal outside steam chests, steel-girder frame, cylindrical guides, centre bearing to crankshaft (except in the smallest sizes), and in engines of 16 n.h.p. and upwards, an outside bearing also.

The automatic expansion gear is of the link type, controlled by the inverted arm Hartnell governor. In short, the engine is built to first-class specification, to a design which appears to have commended itself to nearly all the leading makers, and, with Messrs. Clayton

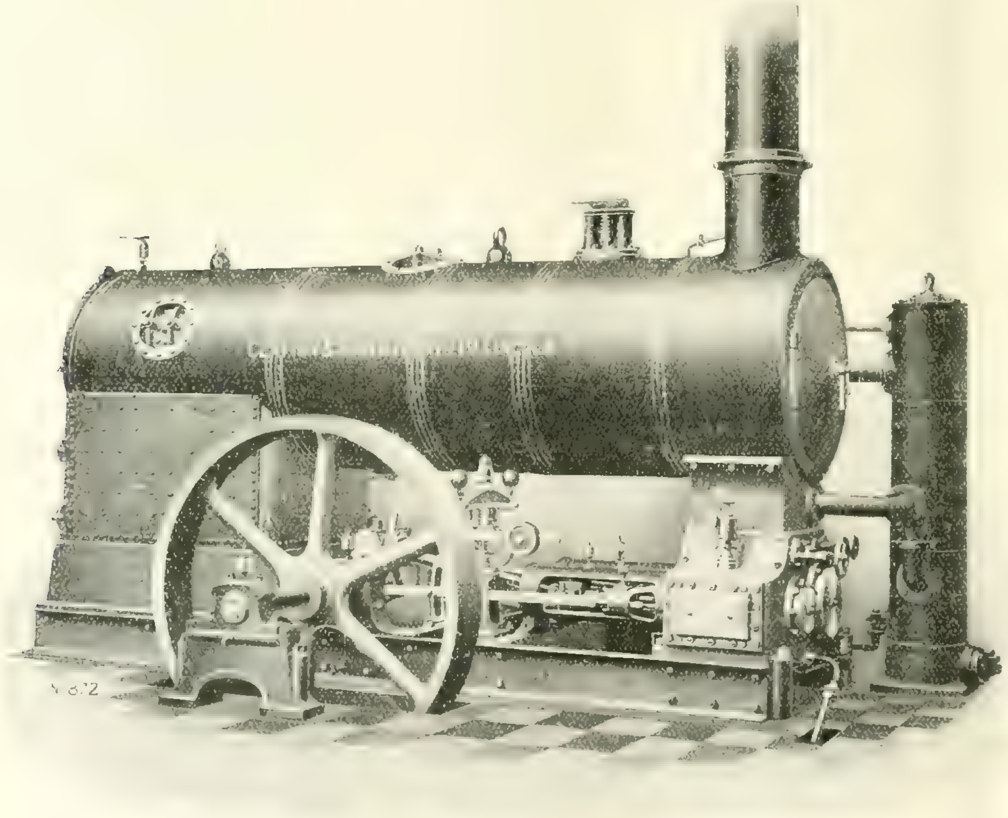


FIG. 11. COMPOUND UNDERTYPE ENGINE BY MESSRS. CLAYTON AND SHUTTLEWORTH, LTD., FOR 150-LB. BOILER PRESSURE.

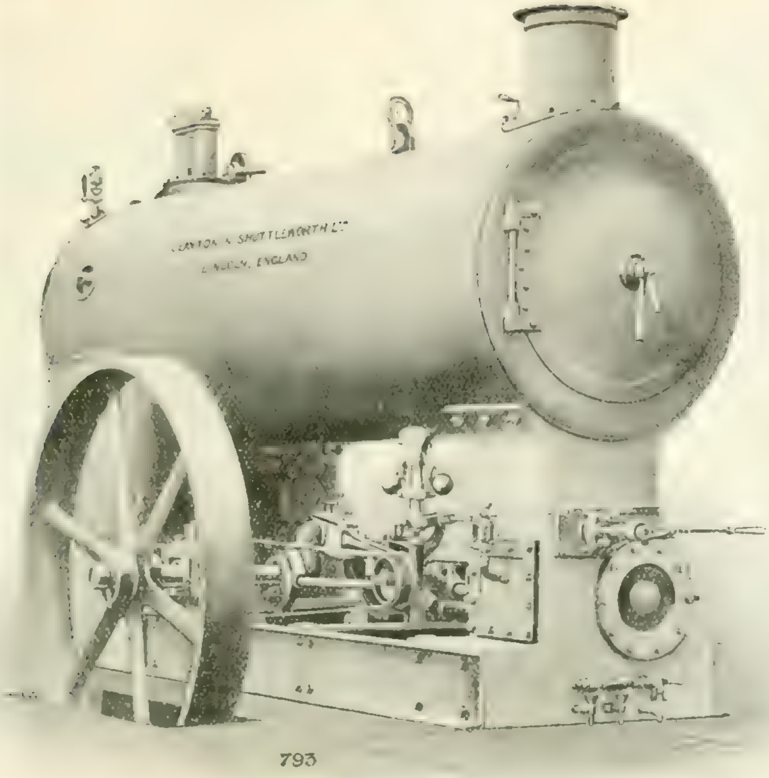


FIG. 12. MESSRS. CLAYTON'S SINGLE-CYLINDER HIGH-PRESSURE UNDERTYPE ENGINE.

and Shuttleworth's well-known workmanship, we confess that it would be difficult to suggest anything in the way of improvement, except, perhaps, in the balancing of the cranks.

The vertical water-heater, shown in fig. 11, is not, we believe, included in the outfit, but is, nevertheless, an adjunct which should form a part of every installation where the utmost economy is studied.

Where there is a good supply of water available, Messrs. Clayton, in common with other makers, are prepared to supply condensers, either of the jet or the surface type, the latter being specially applicable where salt or impure water forms the condensing medium.

Messrs. Clayton's single-cylinder and double-cylinder high-pressure undertype engines are shown in figs. 12 and 13.

No detailed description of either is necessary, as the engravings are exceptionally clear. Messrs. Clayton's dimensions are as under, the cylinder ratio in compounds being 2·6 to 1 :—

SINGLE AND DOUBLE-CYLINDER ENGINES.

Horse Power		Cylinder		Revs.
Nom.	Effective	Dia.	Stroke.	per Min.
[illegible]	[illegible]	[illegible]	12	[illegible]
[illegible]	20–25	[illegible]	[illegible]	140
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DOUBLE CYLINDERS.

[illegible]	[illegible]	[illegible]	[illegible]	140
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	14	[illegible]
[illegible]	40–48	[illegible]	[illegible]	127
[illegible]	50–60	11	14	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

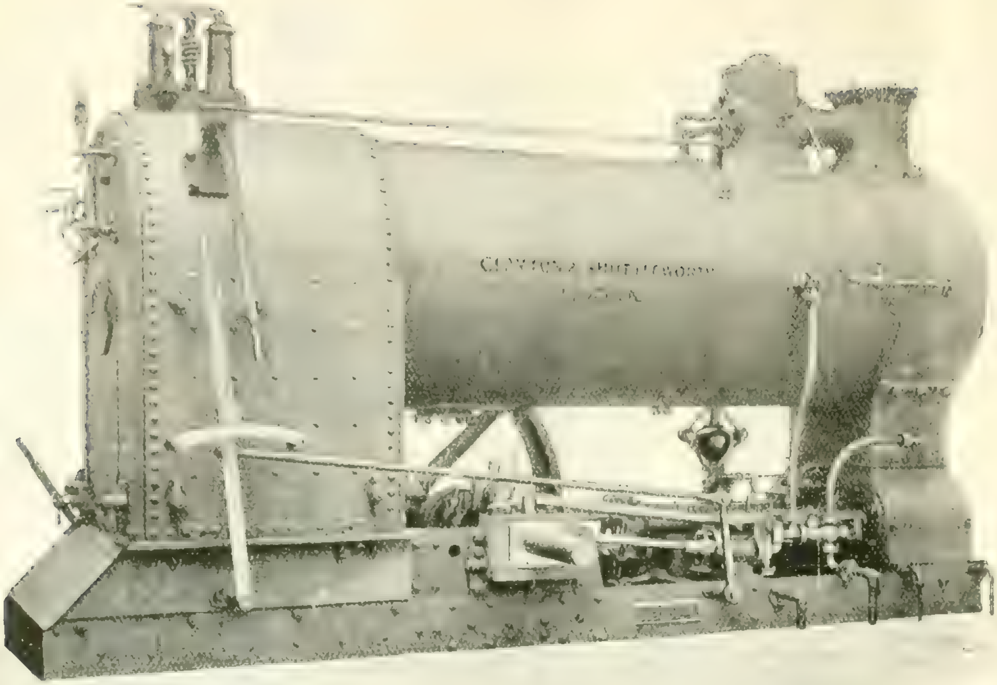


FIG. 13. DOUBLE-CYLINDER HIGH-PRESSURE UNDERTYPE ENGINE BY MESSRS. CLAYTON AND SHUTTLEWORTH.

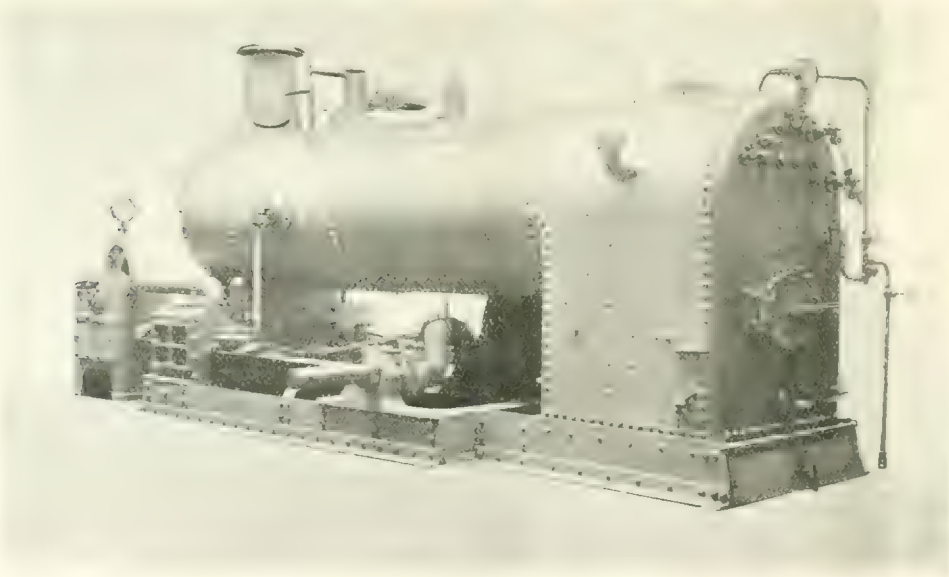


FIG. 14. 16-N.H.P. COMPOUND UNDERTYPE ENGINE BY MESSRS. E. R. AND F. TURNER, LTD.

COMPOUND ENGINES.

Horse Power.		Cylinder		Revs
Nomi.	Effective.	Dia. H.P.	Dia. L. P.	per Min.
10	25–30	[illegible]	[illegible]	[illegible]
12	30–35	[illegible]	11	172
16	40–48	8	[illegible]	150
20	50–60	[illegible]	14½	150
25	63–75	[illegible]	16½	[illegible]
30	75–90	[illegible]	17½	[illegible]

Messrs. E. R. and F. Turner, Ltd., of Ipswich, have favoured us with a photo of their 16 n.h.p. compound undertype engine, the boiler being left unlagged to show the riveting. This particular engine is fitted with condenser, which, of course, is not a part of the regular outfit. The Turner-Hartnell governor controls the admission in the high-pressure cylinder, and there are many other interesting features, such as the single flat guide bar, diagonal bearings, three in number, to the crankshaft (which is bent out of a round steel bar) and the feed-pump, driven by the low-pressure main eccentric rod. (Fig. 14.)

Messrs. Turner make these engines in the following sizes, the average cylinder ratio being a little over 2½ to 1 :—

MESSRS. TURNER'S COMPOUND.

Horse Power		Cylinders			Revs
Nomi.	Indicated (Economical).	H.P.	L.P.	Stroke.	per Min.
12	38	[illegible]	11½	12	180
16	50	[illegible]	12	14	155
20	65	9	14	16	135
25	75	10	[illegible]	[illegible]	[illegible]

In concluding this brief survey of the leading types in this class of engine, we are struck by the fact that, except in minor and unimportant details, the examples we have noticed are, to use a familiar phrase, "as alike as two peas." If we except Messrs. Turner's engine, which contains some original features, there is hardly sufficient difference between any of them for their own makers to recognise them apart, in the absence of the name-plate. Is this due to want of enterprise, or lack of originality, or is it not rather a convincing proof that in its thirty years' existence, the comparatively short-stroke, quick speed, double-cranked compound —whether surmounted by a boiler or not, is, for the moment, immaterial has gradually been refined down by natural selection, to a common standard, the survival of the fittest, to which, it cannot be doubted, every manufacturer has contributed something. Be this as it may, there is no mistake about the resultant of all these efforts. We have in the undertype engine of to-day, a typical product of British brains and energy, of which those who have laboured in its cause may well be proud.

OBITUARY.

Mr. Beauchamp Tower had won a considerable reputation among engineers, and the news of his death at the early age of 59 has been received with general regret. He was a member of the Institution of Civil Engineers, Naval Architects and Mechanical Engineers. From the year 1870 onwards, Mr. Beauchamp Tower was associated with Mr. Froude in the experiments made with the object of improving the design of warships, and, indeed, the apparatus employed was mainly designed by him. He also engaged in independent investigations in other fields of applied science and designed, among other things, the spherical steam engine, a centrifugal pump revolution indicator and a gyroscopic steady platform for guns at sea. He will also be remembered for his experiments in connection with friction, the results of which are recorded in the Transactions of the Institution of Mechanical Engineers.

Mr. Frederick Elkington, who died last week at the age of 78, was the eldest son of Mr. George Richard Elkington, the patentee of electro-plating, and had himself played no small part in the elevation of the art of the silversmith. Outside his commercial career Mr. Elkington was recognised in art circles as something of a connoisseur, and he made a noteworthy collection of Asiatic enamels.

Mr. Thomas Colling Davison was for forty years intimately connected with the iron trade of the Teeside district. He was a partner in the firm of C. E. Muller and Co. who have latterly been largely interested in the Swedish ore trade.

Mr. John Anderson, of Coatham, whose death took place last week, had been for the last half century connected with the blast furnaces of Messrs. Bolckow, Vaughan and Co.

LAUNCHES AND TRIAL TRIPS.

ADDITIONS TO THE NAVY.

The torpedo-boat destroyer *Ness*, built and engined by Messrs. J. S. White and Co., Ltd., at East and West Cowes, to the order of the Admiralty, was launched from the builders' yard last week. The *Ness* is 230 ft. long over all, and has a beam of 24 ft. and depth of 15 ft., and her design throughout is of the most modern type, known as the river class, with high-standing forecastle. She has twin-screws, and her engines, of the three-cylinder, triple-expansion, torpedo-boat type, will give revolutions of 350 per minute when she is going at her full speed of 25½ knots. She will have four boilers of the White-Forster type.

The torpedo-boat destroyer *Gala* was successfully launched from Messrs. Yarrow and Co.'s yard at Poplar on Saturday last.

The torpedo-boat destroyer *Ouse* was launched on Saturday last from the works of Cammell, Laird and Co., Ltd., Birkenhead.

A NEW TROOPSHIP.

The Indian Government troopship *Dufferin*, the largest ship in the world of this class, has completed her official trial. She attained a speed of 18·9 knots, nearly half a knot in excess of her contract speed. She was designed by Sir Edward J. Reed, K.C.B., and is 437 ft. long, with a 52 ft. 6 in. beam, and a displacement of 7,340 tons. She will accommodate 1,200 officers and troops, and has been designed for use as an armed cruiser. The *Dufferin* was built by Vickers, Sons and Maxim.

A BOOTH LINE STEAMSHIP.

Messrs. Workman, Clark, and Co., Ltd., of Belfast, launched on Tuesday from their yard a steamship built to the order of the Booth Steamship Company, (Ltd), of Liverpool. The new steamer, which was named the *Anselm*, is 400 ft. long, with a gross tonnage of 5,600. A large steel deckhouse extending the full length of the bridge deck will be fitted with commodious state-rooms, and altogether accommodation will be provided for 140 first-class passengers. The propelling machinery consists of a set of direct acting triple-expansion engines. The main boilers are of the single-ended cylindrical multitubular type. The vessel has been specially designed for the tourist and general passenger trade to North Brazil, and will run regularly in the service between Liverpool and Para and Manaos.

H.M.S. ARGUS.

H.M.S. *Argus*, built by Messrs. Bow, McLachlan and Co., Ltd., Paisley, has completed an exhaustive series of trials, comprising power, speed, anchor, steering, and gun-firing trials, as also stability tests, all of which were most successfully performed, the power and speed results achieved being in excess of contract requirements.

THE TYNE.

On Saturday last the screw steamer *[illegible]* built by the Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, to the order of Messrs. John Cory and Sons, Ltd., Cardiff, for the Seville and United Kingdom Carrying Company, Ltd., left the Tyne for her trial trip. This vessel is the ninth built for the above firm, and is constructed to the highest class at Lloyd's, single deck, built under special survey. Her dimensions are 335 ft. over all, 48 ft. breadth extreme, and 24 ft. 3 in. moulded.

The machinery has been supplied by Messrs. Richardsons, Westgarth and Co., Ltd., Sunderland, with cylinders 23½ in., 39 in., and 64 in. by 42 in. stroke, and two large boilers 15 ft. diameter, by 10 ft. 6 in. long, with a working pressure of 160 lb. per square inch. The vessel is designed to carry 5,350 tons on a light draft. The trial trip proved in every way satisfactory, the machinery worked without a hitch, and a speed of 10 knots was easily obtained.

HARTLEPOOL.

The new steel-screw steamer *Germanic*, recently launched by Irvines Shipbuilding and Dry Docks Company, Ltd., West Hartlepool, and built to the order of Messrs. W. H. Cockerline and Co., Hull, proceeded to sea for her trial trip. She is of the following dimensions: 342 ft. by 49 ft. 6 in. by 25 ft. 2 in., and of a large measurement cargo capacity. The vessel is built to Lloyd's highest class under special survey, and is of the single-deck type, having poop bridge and top-gallant forecastle.

Engines of the triple-expansion type have been supplied and fitted by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool, having cylinders 23½ in., 39 in. and 66 in. by 45 in., two S. E. boilers each 16 ft. by 10 ft. 6 in. working at a pressure of 180 lb. After adjusting the compasses a series of runs were made, and a mean speed of 11 knots was obtained, the engines working smoothly and well. The vessel then proceeded to Barry to load.

THE WEEK AMONG THE TECHNICAL SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

SIR WILLIAM WHITE ON THE VISIT TO AMERICA.

At a meeting of this Institution on Tuesday last, Sir Guilford Molesworth, President, in the chair, Sir William White, K.C.B., Past-President, delivered an address on "The Visit to the United States and Canada." There was a large attendance of members, and among those present were Lord Strathcona, who was elected an honorary member, Sir Geo. Bruce, and Mr. Alexander Siemens. The lecture, which was illustrated by numerous lantern slides, was listened to with considerable interest. It was repeated to a second audience on Wednesday afternoon. The following is an abstract of the lecture :—

For the first time in the history of the Institution a visit has been paid to America by a representative body of its members.

The first reception by the President, Council, and members of the American Society took place on September 13th. One notable feature of this memorable gathering was the appearance thereat of Mr. Charles Haswell, M. Inst. C.E., who is undoubtedly the "father" of living engineers. He is now in his 97th year and still possesses his full faculties. Mr. Haswell was the first engineer-in-chief of the United States Navy more than sixty years ago, and had personal knowledge of the *Clermont*, the first passenger steamer, built by Fulton. The visit to the New York district continued until the morning of September 19th, the arrangements including visits to a considerable number of important engineering works as well as excursions of the greatest interest. New York and the surrounding district constitute a great field for engineering operations of the most varied and important character. Indeed, it may be said with propriety that, but for the work of the civil engineer, New York could not have become the great and growing city which it is. Unless engineers had provided means for rapid transit—bridges, tunnels, road and railway communications, deep water approaches to the harbour, berths and warehouse for shipping, the wonderful developments in "Greater New York" during recent years could never have been made.

The Rapid Transit Subway was the first among many great works, now in progress in New York, visited.

The demands for transit increase so rapidly that one hears confident expressions of opinion by competent authorities that, before the subway is entirely completed, it will be necessary to begin preparations for another, and so extend to other portions of the city the triple provision of elevated railway, street tramway and subway.

NEW YORK AND CITY DISTRICT.

The electric generating station connected with the subway is placed on the North River between 58th and 59th streets, and was opened for inspection. When completed it is claimed that it will be capable of producing more power than any electrical plant in the world.

In close connection with the question of rapid transit stands the construction of high buildings, which originated in Chicago, and are becoming general in New York and other great cities of America. The party had the privilege, not merely of seeing many completed buildings, but of inspecting some of the largest size while they were in process of construction. This opportunity was the more valuable, having regard to the growing adoption in this country of steel structures for building purposes. It is satisfactory to note one fact : in the production of special sections of steel joists and girders suitable for such buildings, our most recently designed steel works compare favourably with the United states.

Since the constitution of Greater New York the necessity for improved means of communication between Manhattan and Long Islands has been more fully recognised, and steps have been taken to provide them. The Brooklyn Bridge has been open for nearly thirty years, and the daily average of passengers is reckoned at 350,000. The new Williamsburg Bridge, just completed, is like the Brooklyn a suspension bridge, "double-decked," with deep girders between the the two platforms.

The Manhattan Bridge, now building, is situated between the Brooklyn and Williamsburg Bridges. It will be a suspension bridge, the total length (with approaches) being nearly 10,000 ft., and the main span nearly 1,500 ft. Another bridge is in progress—the Blackwell's Island Bridge—further to the north. The span over the main channel will be nearly 1,200 ft., that over the other channel nearly 1,000 ft., and that across Blackwell's Island over 600 ft. There will be six piers, two on Blackwell's Island, and two on each bank. These three bridges will provide for about 1½ millions of passengers per day, and cost nearly 11 millions sterling.

Further improvements in communication between Manhattan Island, New Jersey, and Long Island, are being made by means of tunnels beneath the Hudson and East Rivers, and facilities were granted for visiting these works.

These numerous schemes originate in the immense and growing traffic of the City, and are favoured by the remarkable advances made in recent years in methods and plant for tunnel construction.

BROOKLYN NAVAL YARD.

This is one of the largest and best equipped Government establishments of the kind, and has great natural advantages. The water front is more than 2½ miles in length and the yard contains three graving docks, two building slips, and deep-water jetties at which warships of the largest size can lie afloat. Hitherto, shipbuilding for the United States Navy has been almost entirely conducted in private establishments, but it has recently been decided by Congress to be desirable to build a first-class battleship at New York, in order to compare cost and rate of production with that in private yards. The party had the opportunity of seeing the battleship *Connecticut* practically ready for launching. She is a first-class vessel, which in dimensions, armour, armament, and speed, compares favourably with the largest European battleships. In order to build the *Connecticut* a new slip had been specially constructed with piled foundations. The cantilever cranes used for lifting materials during construction were interesting as examples of American practice. Besides its equipment for building and repairing ships the navy yard has large provision for dealing with the coaling of the fleet, including powerful cranes and large storage capacity. In the latter the coal bins are constructed of concrete and steel, and elevated on steel columns, so that ships lying alongside may have coal run into their bunkers from the bins. A steel tower with projecting arms operates on a track above the bins and so enables the coal to be distributed to the bins. Electrical power has been largely developed in recent years throughout the establishment. The great Croton dam was also visited. The dam is 297 ft. in height, 206 ft. thick at the bottom, 18 ft. thick near the top, and has a length of 1,168 ft., exclusive of the "spillway," which is 1,000 ft. long. The total volume of masonry is 750,000 cubic yards. It impounds 32,000,000,000 gallons in a lake 19¾ miles long, about 3,400 acres in area, with a maximum depth of 146 ft. This is the last of a series of nine dams in the valley, the total storage being 75,000,000,000 gallons impounded from an area of about 360 square miles. One notable feature was the use of two steel towers, on which the derricks were placed at a considerable height above the work. As it rises in height the lower portions of the towers are enclosed in the masonry, and so permanently built in, being tightly sealed with concrete. This plan renders unnecessary the frequent shifting of derricks required when they are placed on the masonry.

THE CANADIAN TOUR.

The party left for Montreal on September 19th. Colonel Anderson, the president of the Canadian Society of Civil Engineers, boarded the train before it reached Montreal and gave us a hearty welcome to Canada. This was an earnest of the cordial receptions offered to members of the Institution at every place visited during the eight days' stay in the Dominion. The time was all too short to do justice to the comprehensive programme which had been prepared, including visits to Montreal, Quebec, Ottawa, Toronto, and Niagara, as well as to many engineering works executed or in progress. At the present time great schemes for the development of the natural resources of the Dominion are in progress and in contemplation. These schemes include the construction of a new Trans-Continental Railway, and of other new and important railway communications—the development of the waterways between the great lakes and the Atlantic, fuller utilisation of numerous sources of water-power for industrial purposes and for the production of electrical energy, as well as many other methods of increasing and transporting the natural products and the growing manufactures of this marvellous country. No engineer who visits Canada can fail to be impressed by the enterprise and courage with which the Government and private Associations are facing these and other great problems, upon the solution of which depends the making of a nation. When it is remembered that the total population of Canada, with its immense extent and wonderful possibilities, is only about 5½ millions of people, the scale and cost of these great engineering works seem even more remarkable. It is, of course, true, and it is a fact of which we may be proud, that British capital has much to do with these undertakings, and it may be hoped that it will occupy the first place. But allowing for this assistance, the utmost credit belongs to Canada for the steps that are being taken to facilitate communication and transport, to develop the natural riches of the country, and to favour the growth of population.

The visits arranged enabled the English visitors to see some examples of the most characteristic features in these several developments. One of the most important features of the new Trans-Continental line of railway is the great bridge to be built about six miles above Quebec. It is to be constructed on the cantilever principle with a channel span of 1,800 ft. (100 ft. more than the Forth Bridge), containing a suspended span of 675 ft. and two cantilever spans each of 562½ ft. The length between abutments is 3,240 ft. The height of the suspended span at the centre is 130 ft.; the height above high tide 160 ft. The bridge is designed to carry two railway tracks in the centre, and a highway and electric railway on each side; all these lines will be laid between the main trusses of the structure which are 67 ft. apart (centre to centre). The height of the main piers above the pier coping is 330 ft. The trusses, tyres, anchorages and floors are to be of mild steel. The piers have been built: their width at the coping is 30 ft., length 133 ft., and height above high tide 30 ft. The width of the anchor piers at coping is 22 ft., and their length 102 ft. The total estimated weight of steel in the bridge is about 32,000 tons, and the weight of the anchor pier counter poise about 11,000 tons. Another interesting visit was that made from Montreal to the Victoria Bridge across the St. Lawrence, the visitors having the advantage not merely of inspecting the structure, but of receiving explanations as to the method by which traffic was maintained during the construction of the new bridge, as well as the means taken for removing the tubular bridge after the new bridge was completed.

The new shops at Angus (near Montreal) of the Canadian Pacific Railway Company are well advanced, and will be the "Crewe" of that system when completed.

THE WATERWAYS OF CANADA.

"The profound penetration and permeation of the country by waterways is the great characteristic of Canada." The visitors saw something of Lake Ontario and Lake Michigan, and passed the southern end of Lake Huron. They saw the Ottawa River from Parliament Hill, and had a most interesting day on the St. Lawrence, when the City of Montreal provided a steamer to convey them through the Soulanges Canal, and back through the famous Lachine Rapids. But they had no indication of the magnitude of the great lakes and rivers, or of the canals that have been constructed to communicate between the lakes and the Atlantic. The extent of the shipping and trade of the lakes is hardly realised here, or the importance attaching to possession of traffic from the lakes to the open sea. On the other side this is well understood, and the competition is keen between the United States and Canada. On the improvement of the Erie Canal it is proposed by the United States to spend about 20 millions sterling. The Canadian Government, about the time of our visit, decided to spend £50,000 on surveys and investigations as to the probable cost of making a new waterway 22 ft. deep from Georgian Bay, on Lake Huron, by the Ottawa River, to Montreal. This would be the shortest distance (425 miles) from the lakes to Montreal, the port lying furthest up the St. Lawrence to which ocean-going ships proceed. By existing routes the shortest distance from Sault St. Marie to Montreal is 950 miles; the new canal would reduce this to 610 miles. The magnitude of the shipping passing through the canals at Sault St. Marie may be seen from the statement that so long ago as 1889 the aggregate tonnage approached 7½ million tons, and exceeded the corresponding tonnage for the Suez Canal by nearly half a million tons, although the navigation was open only 234 days in the year. The Canadian authorities are clearly well advised in endeavouring to improve the communication of such a traffic with the sea *via* the St Lawrence, and the results of the surveys of the Georgian Canal will be awaited with interest.

As to the St Lawrence itself the navigable channel to Montreal for large ships has a minimum width of 300 ft. extending to 550 ft. at the curves; and it is expected that a depth of 30 ft. throughout will be obtained next summer. Extensive works are also in progress for the improvement of the port and for increased accommodation for large ships. These were visited by many members of the party. Montreal obviously intends to maintain its position as the head of ocean navigation, and the terminus of the great canal systems.

The resources of Canada in water-power are unsurpassed. Already large use has been made of them for the generation of electricity and for industrial purposes. What has been done as yet is only a commencement of a great development that will have far-reaching consequences on the future of the Dominion. Many opportunities were afforded to see examples of the utilisation of water-power. No one could fail to realise the enormous possibilities of development in the pulp and paper industry, lumber being abundant and easily brought in rafts down the river to the mills, power cheap, and a good supply of labour available. There is at present a great export of pulp to paper mills in the United States; but Canadians are not slow to realise that paper, rather than pulp, should be their main product. It is said that within a few miles of Ottawa there is [illegible] h.p. of water power, and within a radius of [illegible] miles nearly a million horse power.

UTILISATION OF WATER POWER.

Outside Quebec, at the famous falls of Montmorency, is a very interesting electric generating station. The falls are nearly 270 ft. in height; the head utilised being 200 ft. Five turbines are installed each of 1,000 h.p., and the current is employed in electric traction on the Quebec Railway and for lighting.

Then there are the Shawingan Falls (near Montreal). The falls are about 150 ft. high, and the water-power is estimated to be sufficient to produce upwards of 100,000 h.p. Here water is taken out of the river by a canal 1,100 ft. long, 100 ft. wide, and 20 ft. deep. In the power-house there are installed three pairs of inward-discharge turbines, each pair (at 180 revolutions per minute) being capable of delivering 6,000 h.p. A fourth unit was being installed, and will be capable of delivering 10,500-h.p. The electric energy is utilised in factories from 2 to 20 miles distant, and in Montreal 85 miles away. At the latter city 6,000 h.p. are now being delivered at a pressure of 50,000 volts. Amongst the industries obtaining power from these falls are electric lighting and traction, the manufacture of calcium carbide and ferro-manganese, and pulp mills; linen mills are to follow. Within four years of the time when the Shawingan Falls were accessible only by canoe, they have been thus utilised.

The visit to Niagara was made on September 27th. Apart from the electric installations (which have been described in PAGE'S WEEKLY), numerous and interesting engineering problems are involved in the works at Niagara. Great difficulties had to be faced in making the coffer-dams required for the construction of the head-works. The rapid and turbulent stream and the nature of the river bottom were the principal causes of difficulty, and they were overcome only by perseverance and large expenditure. It was necessary also to provide protection against floating ice, logs, and other solid objects. Careful screening of the intakes was essential, as well as arrangements for deflecting the current and regulating the velocity of flow. At the head-works of the Electrical Development Company, a large area of the river-bed was laid bare, and one could see how curiously the flow of water in the rapids had eroded the rocky bottom.

Two of the three great undertakings on the Canadian side are practically due to American capital and enterprise—a fact which does not redound to British credit, having regard to the enormous amount of British capital available for investment. The third company is distinctively Canadian, and is closely associated with Toronto.

THE ILLINOIS TUNNELS.

Two days were a ridiculously inadequate time to devote to such a city as Chicago, having regard to its special features as well as the great manufacturing and engineering works, which were freely opened for inspection. All that could possibly be done under the circumstances was done.

Members interested in bridge construction were taken on steamers to inspect many different types spanning the river, and had the opportunity of contrasting ordinary swing bridges with island piers in the centre of the channel, with the Waddell Lift Bridge, which can be bodily raised 155 ft. above the water, and with rolling bascule bridges, which have now been generally adopted and have great advantages in leaving clear the whole width of the channel. A large example of the last type was in process of erection, and its interesting details and mechanisms were visible. Others visited electric generating stations, and saw in actual work some of the largest steam turbines of the Curtis type yet made. Probably the most interesting of all these visits was that paid to the central station and tunnels of the Illinois Tunnel Company. This extraordinary enterprise is now far advanced towards completion, after many years work and great expenditure—said to reach four millions sterling. It had a modest beginning. The first concessions were granted for accommodating telephone cables, in connection with a novel system which provides for each subscriber being able to put himself in communication with any other subscriber, without the intervention of attendants at the Central Telephone Exchange. This system is now in operation. The promoters afterwards came to the conclusion that the system of subways might be used for the handling of freight by electric traction, as well as for telephone cables, and they have given effect to that idea on an enormous scale. Subways of small sectional area have been formed, at a moderate depth below the surface, under all the principal streets of the business quarters, and equipped for electric traction. By this means it is hoped that overcrowded thoroughfares, along which stand the high buildings used as offices, warehouses, and stores, will be relieved of the heavier traffic and freight. The visitors were taken through miles of these tunnels and their sidings, finally emerging on the lake front, where a great scheme of reclamation is in progress, and a public park is to be formed. The tunnel scheme has been worked out with thoroughness and skill; it provides for underground stations and sidings at the great railway termini, and in the basements of warehouses and stores. Local conditions of subsoil have favoured the construction of these tunnels, and reduced outlay, but they undoubtedly constitute a great engineering undertaking.

The South Chicago Works of the Illinois Steel Company were also visited. This is one of three establishments belonging to the company, which has a capital of seven millions sterling and employs 10,000 men. The works at South Chicago cover more than 300 acres, and include the largest rolling mill in the world. All departments of iron and steel manufacture are represented, the equipment is of the most modern type, and the output is extremely large. One of the most interesting features was the powerful plant operated by electric power, used for rapidly discharging cargo from steamers lying at the wharves immense weights of iron ore, and for transporting this ore to the great blast furnaces situated within easy reach of the stores of iron ore and the wharves. The resultant economy in cost of transport which accompanies increased dimensions in steamships has not been overlooked on the lakes, and the last few years have witnessed enormous developments, vessels being now employed which can carry upwards of 10,000 tons of dead weight.

CHICAGO DRAINAGE CANAL.

A good many of the visitors inspected the Chicago drainage canal. This canal, although designed primarily for sanitary purposes, is now regarded as part of a grand scheme for a deep waterway from Lake Michigan to the Mississippi river. It is pointed out that the work is easy of accomplishment because of the existence of the sanitary canal; that the people of Chicago have already expended almost 43 million dollars on their sanitary canal, and will have to spend 55 million dollars on the completion, whereas the estimated cost for the entire remainder of the work does not exceed 27 million dollars. The volume of water which will be carried by the canal when completed is designed to be 600,000 cubic ft. per minute.

The visitors had an opportunity of inspecting the ingenious controlling arrangements which have been constructed at the southern end of the canal, and seeing the "bear-trap" dam worked. There are seven sluice gates of metal with masonry bulkheads, each having an opening 30 ft. in width, with a vertical play of 20 ft. The bear trap dam has an opening of 160 ft. and a vertical oscillation of 17 ft. This dam consists of two great metal leaves hinged together and working between masonry bulkheads. The downstream leaf is securely hinged to the foundation, and the raising or lowering of the dam is accomplished by the admission or a charge of water through regulating valves. It will be seen from a comparison of this canal, with other existing ship-canals, that the people of Chicago have given another proof of their enterprise and courage in having undertaken and carried out this great work on a scale sufficient to make it form part of an inland channel for ships from the lakes to the Mississippi. The effect on the commerce of Chicago must be immense.

The party also visited the St. Louis International Engineering Congress.

CONCLUSION.

There can be no doubt but that this visit enabled American and Canadian engineers to give practical proof of their fellowship with British engineers. One effect of the visit, it is hoped, will be the extension of the membership of the parent Institution of Civil Engineers to many eminent American and Canadian engineers charged with the conduct of the great works incidental to the development of the resources and communications of that continent.

The development of the Dominion is in an early stage, but those charged with the responsibility of Government are fully alive to the grandeur of its resources and its potential greatness. The realisation of this policy largely depends upon the execution of engineering works of enormous magnitude. In Canada is to be found a splendid field for British enterprise and capital. Canadian engineers, without exception, expressed the hope that, in the organisation and conduct of the great works now contemplated or to be undertaken hereafter, they will have the assistance of British engineers, and especially of young engineers. No better school for aspirants in the profession can be found than that afforded by the Dominion. In these islands from the nature of the case, fewer and fewer opportunities for great engineering undertakings will present themselves; but in Canada one sees only the beginning of things, with immense possibilities in the immediate future. What is true of Canada is true also of our other colonies and dependencies, and it may be hoped that in the future British enterprise and British capital will be more largely devoted to the development of the resources of the British Empire, and less to corresponding work in foreign countries. Within its limits are to be found in profusion all natural riches, both vegetable and mineral, which are essential to the sustenance of the people, or as the raw materials of manufactures. In its manifold and varied sources of power, the command of labour, the number and generally prosperous condition of its population, the skill and experience of its industrial leaders and workers, the Empire as a whole is unrivalled. On all sides lie possibilities for development and it is our duty to see that the great heritage which has come into our possession shall be enriched and consolidated. The "building-up" of the British Empire is the concern of all its citizens; not the peculiar task of statesmen. In this great undertaking it is certain that civil engineers must play a most important part, and that the influence of the Institution of Civil Engineers must be even greater in future than it has been in the past.

RUGBY ENGINEERING SOCIETY.

PATTERN MAKING.

At the meeting of this society held on the 5th inst., a paper on this subject was read by Mr. R. Watson, of which the following is an abstract:—

Upon receiving a drawing in the pattern-shop, if the work is at all complicated it is set out full size, but in some cases sections only are required for the construction of the pattern and arrangement of cores. Machining allowances are shown. All the setting out is done to a contraction rule, so that any dimension which may be taken is the pattern size. The first thing which has to be done is to determine the best way of moulding the chief things, governing which are the principal machined surfaces; these are placed in the bottom of the mould to ensure their being clean and free from defects. Another point to be settled is the readiest way the cores can be put in the mould. Patterns should, in all cases where possible, be parted and dowelled together on the joint line of the mould, as in the case of a cylinder, through the centre line of the circle, so that when the top part of the moulding box is lifted off, the portion of the pattern covered by it is taken with it. Then the moulder can loosen each part separately and see what he is doing on drawing the pattern from the mould. Loose pieces, such as bosses and facings, cannot in all cases be avoided, and on permanent patterns these should be fixed on by a dovetail. One method of getting over the difficulty of several loose pieces is to put them all together in a core, but with dry sand work this often leaves a mark on the casting.

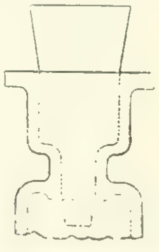


FIG. 1. SHOWING TAPER TO GIVE CLEARANCE.

In constructing large patterns wide pieces of timber should be avoided because of the shrinkage and expansion. Frames made of narrow pieces and half lapped together at the corners can often be used with advantage. Patterns made of dry timber will expand when left in the mould for any length of time and contract when stored away. Where possible the grain of the wood should run in the direction that the pattern is going to be drawn from the mould.

In large patterns, such as bedplates, good provision should be made for lifting as it adds considerably to the life of the pattern. Heavy standard patterns are often more damaged in lifting about than in actual use in the foundry.

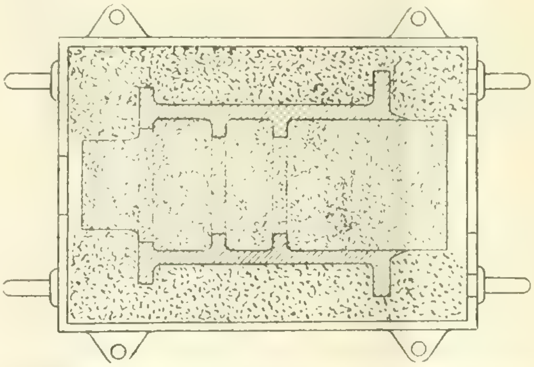


FIG. 2. SHOWING CHAMPHER TO PREVENT EDGE OF MOULD BREAKING DOWN.

The question of taper is often a very debatable subject between the pattern maker and moulder. There is no standard rule, each piece of work requires separate consideration. In most cases $\frac{1}{8}$ in. to the foot is found to be sufficient, but on the inside of ribs and brackets where size is of little consequence more may be given. In prints where the core comes through the top moulding box for convenience of centring or releasing the core, etc., the size of the print is still kept the right size near the pattern, but tapered larger to give clearance for passing the core down as shown in fig. 1. No two prints on a pattern should be the same size, or nearly the same size, or probably the mould will be cored up wrong. In prints that mould horizontally the root should have a slight champher on it as shown in fig. 2, as this prevents the edge of the mould breaking down when the core is put in. If this is not done the moulder generally takes it off with his trowel each time he makes a mould.

Cores are often more difficult than the outside of the pattern; it often takes considerable time to arrange them so that they may be put in the mould in the readiest possible way.

In large cores allowance has to be made for expansion in drying to the extent of about [illegible] in. to the foot.

Large cores where possible should be made the same way up as they are to be put into the mould, for convenience of getting at the iron to lift them by when fixing.

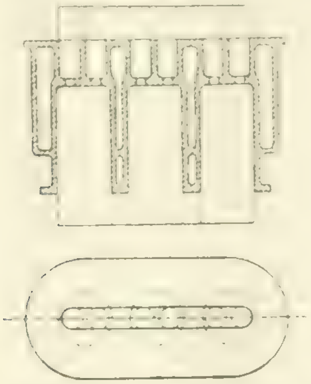


FIG. 3. DOTTED LINES SHOW SEPARATE PRINTS AS COMMONLY MADE.

Where cores have to bore out to exact centres in relation to each other, as in the case of motor cylinders, where two or three boxes are in the same casting, these should be made in one core box tied togther by continuous prints at both ends as shown in fig. 3. This admits of a good stiff core-iron which can be readily broken without any risk of breaking the casting. In small cores, where great accuracy is required and where the metal is very thin, the core should be made about $\frac{1}{32}$ in. smaller in size than is required, to allow for blacking, and care must be taken that the cores fit their prints, for when once rubbing is commenced on the core, no two castings will be identical.

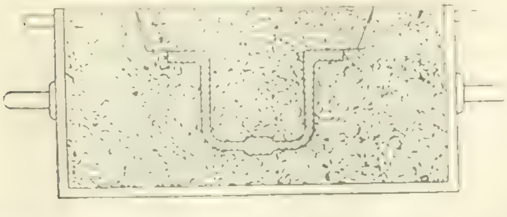


FIG. 4. THE CORE TAKES THE PLACE OF THE TOP MOULDING BOX.

Light castings such as covers, caps, cone-pulleys etc., may be made so that the core takes the place of the top moulding-box and is self-centring, as shown in fig. 4. This core must be at least $1\frac{1}{2}$ in. thick and 1 in. larger all round than the casting, so that it will bear sufficient weight being placed on it to withstand the lift while the mould is being poured.

One good method that is practised by some of the larger firms is to paint "black" parts that are not to be machined, "yellow" parts that are machined and "red" for prints and parts where the core cuts through the metal.

There is often a difference of opinion as to the right amount of contraction to allow on special large work and the following table shows a safe rule to work upon :—

General iron	
Loam work cast vertically	[illegible]
Brass	
Phos. bronze	[illegible]
Steel	
Aluminium	
Malleable iron	
Lead	

INSTITUTION OF CIVIL ENGINEERS.

YORKSHIRE STUDENTS' ASSOCIATION.

A meeting of the above Association was held on 5th inst., in the Law Institute, Leeds, the President Mr. E. Matheson, M.Inst.C.E., in the chair, when a paper was read by Mr. S. R. Kay, M.Inst.C.E., on "Considerations affecting the Design of a Viaduct as exemplified in the Conisborough Viaduct, to be built for the Dearne Valley Railway."

After explaining the position and nature of the railway and the conditions under which the River Don has to be crossed as Conisborough, Mr. Kay showed how the geological conditions and the near presence of colliery workings affected the choice of a suitable design. If an arched viaduct were to be built it would be necessary to purchase sufficient coal underneath to ensure stability, while in the case of a steel structure this would not be so important.

A useful formula for estimating the amount of coal to be bought to give safety from subsidence is

[illegible]

where r = radius of supporting pillar in yards.
d = depth of seam in yards.
a = thickness of seam in feet.

The most economical spans for different types of viaducts were found to be as follows :—

For brick arches	50–60 ft.
For steel girders erected on staging	100 ft.
For steel girders erected on ground and lifted into position	150 ft.

Having considered the various types it was finally decided to purchase the coal and build an arched viaduct. The viaduct will consist of 21 semi-circular brick arches of 55 ft. span, divided into three bays of seven each. These bays are separated by the river span and by a stop pier midway between the river and west abutment. The river span is of steel lattice girders 150 ft. span, with steel-plate flooring and weighs complete 310 tons. Total length of viaduct, 300 yards. Height above river 110 ft. The stresses allowed were 8 tons per square foot on brickwork at springings and 9 tons per square foot at bottom of piers. This was reduced to 3 tons per square foot on foundations for clay and marl, and 3·7 tons for hard gravel.

The viaduct will be faced with brindled bricks in lime mortar for the upper portion and cement mortar below flood level. The piers are battered 1 in 36 The haunches will be filled with concrete covered with 1 in. of asphalt and fitted with drains.

The brickwork amounts to 23,000 cubic yards; excavation, 22,200 cubic yards; concrete (8 to 1), in foundations, 11,000 cubic yards; in haunches 3,900 cubic yards.

The difficulties of the site are increased by the fact that the only access to the site is by canal, the nature of the ground at each end precluding the use of contractor's lines overland. It is proposed to instal a cableway to deal with loads up to 3 tons. The paper was illustrated by diagrams.

An interesting discussion followed in which Messrs. Perkin, Rudyard, Lister, Matheson, and Miles took part. In the course of his remarks the latter gave the following rule for estimating the cost of brick viaducts of moderate height (40–80 ft.) for a double line of rail way. The cost per yard run may be taken at £1 per foot of height. For each foot of height above 80 ft. add 1 per cent.

Mr. Kay having replied to the points raised in the discussion, the meeting closed.

BIRMINGHAM ASSOCIATION OF MECHANICAL ENGINEERS.

At a recent meeting of the Birmingham Association of Mechanical Engineers, Mr. W. Bardill read a paper on "Engineering Works' Policy and Modern Competition." The author pointed out the necessity of keeping machines running up to their full output, although admitting that even this stage might be reached and yet see a balance on the wrong side at the end of the year. Hence, the necessity for seeing that the work was yielding a fair margin of profit, which was, of course, the great problem. In these days of competition this could only be done by reducing the cost of production. Here was the great field for the engineer, where the fight of the future would have to be fought. Cheap labour, taking a broad view, was an absolute fallacy as a means towards reducing working expenses and a policy of slave-driving generally ended in failure. To get the best work out of a man he had to be made to feel happy and comfortable to be fully trusted, to be made to feel that between himself and the employer there was a community of interests, and that he was a capable and intelligent part of the organisation. There were many ways of cutting down costs, such as the careful subdivision and supervision of departments and the introduction of the premium system or the piece system. Another point worthy of attention was the careful preparation of prime costs and the introduction of improved systems for the better working o the commercial part of the business. The American method of "firing the fools" and the riddance of obsolete tools could not be too strongly recommended, but the greatest help of all in cost reduction was the introduction of labour-saving appliances. The selection of staff had much to do with the success of a business, and a keen, sharp-witted foreman—one who knew the long and the short way of doing things—had more opportunities than anybody else of effecting reductions in cost. Under the chiefs of departments should be sub-foremen, chosen from the staff to encourage the others, so that every workman might feel that he had a chance of rising above trade union pay.

Mr. Bardill's paper produced an excellent discussion, contributed to by Mr. J. Batey, Mr. E. A. Dowson, Mr. R. B. Hodgson, Mr. M. Stanley, Mr. W. Deakin, Mr. J. Lord, Mr. W. H. Thornbery, and Mr. J. S. Orton.

The Efficiency of a Gasometer.

It would be interesting if someone would carry out an investigation as to the efficiency of a gasometer when new, and also when it has been in use for some years. There is no doubt that as time goes on the efficiency does fall off, indeed, in one case the writer has heard of, the pulling down of an old gasometer and installing a new one increased the dividends of a certain company from one and a-quarter to five per cent. It was found that the joints between the plates had opened by reason of the plates oxidising. M. Pretty, M.Sc., A.M.Inst.C.E., of Leicester, informs the writer of some investigations he has made on the subject which go to show the increased space occupied by the oxides and hydrated oxides of iron ranges from 40 to over 100 per cent., the latter being when there is a good deal of water with the oxide. Independently of any actual opening through which the gas can escape, it is probable that a certain amount of diffusion goes on through the oxide in the joints.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts

CONTRACTS OPEN.

Last Day

Poole.—Construction of quay wall in ferro-concrete for Harbour Commissioners. Mr. H. F. J. Barnes, Towngate Street, Poole ... Jan. 14

Bengal and North-Western Railway.—Supply of stores. Mr. Alex. Izat, Managing Director, 227, Gresham House, E.C. ... Jan. 16

Manchester.—Supply of iron and steel-work, hydraulic tipping-rams and turn-table for elevated railway at Gaythorn station for Gas Committee. Mr. T. G. Newbigging, engineer, Rochdale Road Station ... Jan. 16

Southern Mahratta Railway.—Supply of steel materials for pairs wheels and axles. Mr. E. Z. Thornton, Secretary, 40, Queen Anne's Gate, S.W. ... Jan. 17

Bombay, Baroda and Central India Railway.—Supply of miscellaneous stores in two sections. Mr. T. W. Wood, Secretary, Gloucester House, Bishopsgate Street Without, E.C. ... Jan. 17

Great Western Railway.—Extension of steel superstructure of Cricklade Road Bridge. Engineer, Paddington Station ... Jan. 17

East Indian Railway.—Supply of spiral springs, cast-iron sleepers, and engine turntables. Mr. C. W. Young, Secretary, Nicholas Lane, London, E.C. ... Jan. 18

Bamford.—Manufacture and supply of cast-iron pipes for a section of Derwent aqueduct for Derwent Valley Water Board. Mr. O. B. Steward, Bamford via Sheffield ... Jan. 23

Grimsby.—Supply of plant and material for electrical department. Mr. W. A. Vignoles, Corporation Electricity Works, Grimsby [illegible] ... Jan. 23 Feb. 1

Swindon.—Supply and erection of Lancashire boiler with downtake superheater, etc., for Corporation. Mr. J. G. Griffin, Electricity Works, Swindon ... Jan. 24

South Indian Railway.—Supply of [illegible] steel covered goods wagons, spoke wheels and axles and laminated bearing springs. Mr. Henry W. Notman, Managing Director, 55, Gracechurch Street, E.C. ... Jan. 24

Netherlands.—Supply of ironwork, soft steel, general ironware, corrugated galvanised soft steel sleepers, metal superstructures for bridges, etc. ... Jan 25

Harrogate.—Supply and delivery of welded steel pipes and other materials in connection with the Masham Scheme Works; to be delivered at Ripley Station of the North-Eastern Railway. Mr. Edward Wilson Dixon, Engineer, Albert Street, Harrogate ... Jan. 2[illegible]

Ebbw Vale.—Construction of Carno reservoir (three contracts). Engineer, Mr. Geo. F. Deacon, 16, Great George Street, Westminster, S.W.

Manuden.—Erection of an iron girder bridge at Common Mead, Manuden, Essex, for the Stanstead Rural District Council. Mr. Chas. Hicks, Surveyor, Stanstead, Essex ... F[illegible]

South Shields.—Execution of works and supply of plant in connection with the construction of overhead electric tramways. Mr. J. Moore Hayton, Town Clerk. Feb. 20

Kirkcaldy.—An extension of about 500 ft. to present East Pier for the Town Council. Mr. Wm. L. Macendoc, Town Clerk ... Feb. 4

Nottingham.—Construction of reservoir at Wilton Hill. Mr. F. W. Davies, Water Engineer, Water Offices, St. Peter's Square Feb. 13

Lulea (Sweden).—Widening and deepening of the Channel, "Tjufholssundet," at Lulea. Harbour Commissioners, Lulea, will supply particulars ... April 1

CONTRACTS CLOSED.

Tokyo.—Messrs. Dick, Kerr and Co., Ltd., are now shipping 250 tons of electrical machinery, on their contract for the complete equipment of the Tokyo Denki Tetsudo Kabushiki Company's tramways. The system, when completed, will cover about 60 miles of line, and operate 250 cars.

Brazil.—The Brazilian Government has concluded a contract with Messrs. Siemens and Halske for the installation of two wireless telegraph stations—one on the island of Cobras, and the other on the cruiser *Riachuelo*.

Admiralty.—The contract for the electrical equipment of Malta Dockyard has been placed with the Lancashire Dynamo and Motor Company.

Liverpool.—The ventilating apparatus for the latest additions to the Cunard fleet have been supplied by a local firm, viz., Messrs. John Gibbs and Son, Duke Street, Liverpool. These ventilators have, for many years, been used by the Cunard Company.

Church Stretton.—The tender of W. Morley and Sons, of Keighley, has been accepted for sewerage works, price £7,578.

United States.—The contracts for the new United States battleship *New Hampshire* and the armoured cruisers *North Carolina* and *Montana* have been awarded. The *New Hampshire* will be built by the New York Shipbuilding Company, their bid being one of £740,600, the vessel to be completed in 38 months. The two armoured cruisers will be built by Newport News Company [illegible]

Transvaal.—The Government have just placed through the Crown Agents a contract for a large quantity of fencing materials with the fencing department of Messrs. A. and J. Main and Co., Ltd., London and Glasgow, with urgent instructions for the promptest possible shipment to the colony.

France.—The London and Glasgow Engineering and Shipbuilding Company, Govan, have received an order from a French firm to build a passenger steamer of about [illegible] tons.

London County Council.—Messrs. W. C. Martin and Co., Glasgow and London, have just secured the order for the electric lighting of the thirty new steamers building for passenger traffic on the Thames for the London County Council.

Govan. — Messrs. M'Kie and Baxter, engineers and shipbuilders, Govan, have placed with Sir William Arrol and Co., Ltd., a contract for an extension which involves the doubling of the erecting and machine shops, the building of a new smithy, new pattern shop, store and finishing shop, and entirely new commercial and drawing offices at Govan.

Admiralty.—The Rivet and Bolt Company, Ltd., of Coatbridge, have received an order to supply 300 tons of rivets per week for a period of three years.

Cardiff. — The Cardiff Town Council have placed orders for two 1,600-i.h.p. engines, with extras, with Messrs. Musgrave and Co., Bolton, and two 1,100-kilowatt generators with the General Electric Company, Birmingham.

Devonport.—Messrs. Graham Morton and Co., Ltd., of Leeds, have just obtained the contract for the supply delivery and erection, at the Electrical Generating Station at H.M. Dockyard, Devonport, of a complete coal-handling plant, including coal bunkers, stanchions, girders, flue, and coal measuring and weighing apparatus and all accessories appertaining to same. All materials used are to be of British manufacture throughout. It is but a short time since this firm received an extensive contract for the Admiralty, at Chatham Dockyard.

COMING CONTRACTS.

Kingswood.—An inquiry has been held into the application of the District Council to borrow £21,000 for sewerage works.

Bolton. — Sanction has been obtained to borrow £65,459 for the extension of the Hacken sewerage works.

Bradford.—A proposal has been brought before the Town Council to spend £40,000 on electric lighting works.

Fife.—A committee has been appointed in connection with the proposal to construct a light railway from Falkland Road Station to Falkland burgh. The cost of carrying out the scheme is estimated at £10,500.

Gloucester.—The City Council have approved a scheme providing for the extension of the electric lighting at a cost of £15,000.

Russia. The Commercial and Industrial Gazette (St. Petersburg) states that, in view of the increased traffic, more especially military, along the Siberian Railway, the Ministry of Ways and Communications has decided to lay new rails along almost the whole extent of the line.

Switzerland. — The Feuille Fédérale Suisse of December 21st publishes a Decree granting M. R. Vontobel, of Winterthour, and M. Charles Probst, of Lucerne, a concession for the construction of a narrow-gauge electric railway from Meiringen to Gletsch. The total cost of the enterprise is estimated at 6,040,000 fr. (about £241,600) of which 490,000 fr. (about £19,600) is to be expended on rolling stock.

Finland.—The Finland Gazette states that the Director-General of Merchant Shipping in Finland is about to have several harbours of refuge constructed on the Baltic Coast. Provision has been made for these works in the latest Budget.

APPOINTMENTS VACANT.

Last Day

Carnegie Research Scholarships.—The Council of the Iron and Steel Institute will shortly proceed to award Research Scholarships founded by Mr. Andrew Carnegie. Candidates, who must be under 35 years of age, must apply on special forms to be obtained from Bennett H. Brough, Secretary, Iron and Steel Institute, 28, Victoria Street, London, S.W. ... . Feb. 28

Woolwich.—Supervisors at Royal Ordnance Factories. Salary £150 to £220. Particulars of the Chief Superintendent ... —

Huddersfield.—Assistant lecturer in the Technical College. Salary £130. Particulars of Mr. Thomas Thorp, Secretary .

Bradford. — Second Assistant Electrical Engineer, Salary £250. Application to Mr. Fred Stevens, Town Clerk ... ... Jan. 19

London.—Three Assistants, City and Guilds Central Technical College, Salaries £200, £150' and £150. Applications to Professor Ayrton, at the College Exhibition-road, London, S.W. ... ... —

Bombay, Baroda, and Central India Railway. Assistant electrical engineer A five years' agreement at a salary of Rs.400 per calendar month. Mr. T. W. Wood, Secretary, Gloucester House, Bishopsgate Street, E.C. ... Jan. 31

India Office.—A head draughtsman for the service of the Government of India. Salary Rs.350 per calendar month, rising to Rs. 500 per month. Particulars and forms of Director-General of Stores, India Office, Whitehall ... . —

APPOINTMENTS FILLED.

California. Professor Harris J. Ryan has resigned his professorship in Sibley College, Cornell University, to accept a call to the head of the Department of Electrical Engineering of Stanford University, Palo Alto, Cal.

Blackburn. — Mr. Harold W. Seymour has been appointed car-shed superintendent of the Blackburn Corporation Tramways.

Worcester.—Mr. C. M. Shaw has been appointed City Electrical Engineer in succession to Mr. C. J. Sutherland, who is retiring owing to ill-health. Mr. Shaw has been filling the position of Electrical Engineer at Wakefield.

Wolverhampton.—Mr. Edward Raynes has been appointed convassing engineer and general commercial agent.

Belfast.—Mr. A. A. Blackburn, A.M.I.E.E., car-shed superintendent of the Manchester Corporation tramways, has been appointed to the position of car-works superintendent to the Belfast Corporation tramways, at a commencing salary of £300 per annum.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

Stock Exchange Settling Days.—Settling days on the Stock Exchange are as follows:—

Consols: February 1st. General Settlements: January 13th, 27th, February 10th. Bank Rate, April 21st, 3 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible] Pneumatic Engineering, L[illegible] ..	1	2½— 3
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	[illegible]
3,210,000	1	[illegible]	[illegible] Sir W. G. W[illegible] Co., Ltd	1	[illegible]
76,970	5	2/-	Do. 4% Cum. Pref..	[illegible]	[illegible]
1,[illegible]	100	4	Do. 4 1st Mort. Dbs. Rd	100	100 — 10[illegible]
[illegible]	100	[illegible]	[illegible] and Porter, Ltd., 4% Red. Mt. Deb. [illegible]	100	[illegible]
[illegible]	1	1/7	Babcock and Wilcox, Ltd , Ord. ..	1	[illegible]
[illegible]	1	7/1	Do. ,, 6% Cum. Pref.	1	1[illegible] — 1[illegible]
20,000	5	[illegible]	[illegible] and Sons, Ltd. [illegible]	[illegible]	[illegible]
[illegible]	1	[illegible]	Baldwins, Ltd., 5½% Cum. Pref. .	1	[illegible] — 1
[illegible]	Stk	[illegible]	Do. [illegible] Red	100	[illegible]
150,000	[illegible]	[illegible]	Barrow Hæmatite Steel Co., Ld., O	[illegible]	1[illegible] — 1
50,000	[illegible]	[illegible]	Do. do. Cum 2nd. Pref	[illegible]	[illegible]
33,334	[illegible]	2/-	[illegible] Ltd [illegible]	[illegible]	[illegible]
£500,000	100	—	[illegible] Ltd. [illegible] 1st Mt. Deb. [illegible]	100	[illegible]
[illegible]	10	[illegible]	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¼— 12¼
[illegible]	Stk	4	Do. [illegible]	100	[illegible]
[illegible]	1	6/-	[illegible] Ord.	1	[illegible] — 1
[illegible]	1	[illegible]	[illegible] Ltd., Ord	1	[illegible]
300,000	1	[illegible]	Do. [illegible]	1	[illegible]
[illegible]	Stk	4½	Do. [illegible] Stock	100	[illegible] 97
1,629,760	1	[illegible]	Bolckow, Vaughan and Co., Ltd. O. Nos. 1-1,629,760	1	[illegible] — 1
1,[illegible]	1	[illegible]	Do. Nos. 1,639,101-3,500 000	1	[illegible]
[illegible]	1	[illegible]	Brown (John) and Co., Lim., Or ., Nos. 1-1,160,000	15/-	[illegible]
[illegible]	1	6d.	Do. Ord., Nos. 1,160 001-1,750,000	1	[illegible]
[illegible]	10	[illegible]	Do. [illegible]	10	11 — 11[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2/-	Do. 5% Cum. Pref. ..	5	[illegible]
[illegible]	1	[illegible]	Clayton & Shuttleworth, Ltd., Ord.	1	[illegible]
[illegible]	[illegible]	2/-	Do. 5% Cum. Pref	[illegible]	[illegible]
[illegible]	Stk	4	Do. [illegible]	100	100 —102
100,000	[illegible]	[illegible]	Consett Iron Co., Ltd., Ord.. ..	[illegible]	[illegible]
[illegible]	1	[illegible]	Delta Metal, Ltd. Shares	1	1[illegible]
1[illegible]	1	3/6.	[illegible]	1	[illegible]
[illegible]	Stk	4	[illegible]	100	[illegible]
£250,000	Stk	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3/-	Dunderland Iron Ore Co., Ltd , 6% [illegible]	[illegible]	[illegible]
[illegible]	1	[illegible]	Dunlop (James) & Co., Ltd., Ord ..	1	[illegible]
[illegible]	1	7/-	[illegible]	1	[illegible]
4,721	13	[illegible]	[illegible] Ltd.	13	[illegible]
[illegible]	13	12/-	Do. do. do.	10	[illegible]
[illegible]	10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	10	[illegible]	[illegible]	10	[illegible]
186,748	Stk	[illegible]	Do. Deb. [illegible]	100	[illegible]
[illegible]	10	[illegible]	[illegible] Ltd., 6% Cum. Pref.	10	[illegible]
[illegible]	Stk	4½	Do. [illegible]	100	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]
[illegible]	3	[illegible]	Do. 7½% Cum. Pref.	[illegible]	[illegible]
965,000	1	1/-	[illegible]	1	[illegible]
[illegible]	[illegible]	2/-	Do. [illegible]	[illegible]	[illegible]
£1,850,500	Stk	4	Do. [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Gwynnes, Ltd., 5% Cum. Pref.	[illegible]	[illegible]
250,000	1	1	Hadfield's Steel F[illegible]ry Co., Ld., Ord.	1	[illegible]
[illegible]	10	[illegible]	[illegible]	10	[illegible]
30,000	[illegible]	3/-	[illegible]	[illegible]	[illegible]
408,505	1	1/-	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	7	[illegible]	[illegible]	[illegible]
[illegible]	1	7/-	[illegible] Ord	1	[illegible]
[illegible]	[illegible]	[illegible]	Do. [illegible]	[illegible]	[illegible]
30,000	10	6/-	[illegible] Ltd., [illegible]	8	5¾— 6¼
[illegible]	1	6d.	Howard & Bullough, Ltd., Ord. ..	1	1 11/16 — 1 13/16
25,000	10	[illegible]	Do. 6% Pref. (Non-Cum.) ..	10	[illegible]
£250,000	Stk	4	Do. 4% Deb. Stk., Red after 1905	[illegible]	[illegible]

ENGINEERING, IRON, AND STEEL COMPANIES. [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
37,500	10	20	[illegible] Ltd	10	[illegible]
49,537	10	[illegible]	Do. Cum. Pref. 5%	10	[illegible] — 10[illegible]
300,000	1	[illegible]	[illegible] Ltd. [illegible]	1	[illegible]
50,000	5	[illegible]	Do. 5½% Cum. Pref... ..	[illegible]	[illegible]
40,000	3	2/1½	Leeds Forge Co , 7% Cum. Pref. ..	3	[illegible]
200,000	1	7	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 — 1[illegible]
£300,000	Stk	4	Do. [illegible] 1st Mt. [illegible]	100	[illegible]
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	[illegible]
[illegible]	1	6d	[illegible] Ltd., Ord.	1	[illegible]
75,000	1	6½d.	Do. [illegible] Pref.	1	[illegible]
£75,000	Stk	4	Do. [illegible] 1st Mt. Db. Stk. Red	100	[illegible]
[illegible]	5	2/6	[illegible] Ltd	[illegible]	[illegible]
[illegible]	5	5%	Do. Pref.	5	[illegible]
5,000	[illegible]	47/6	Nantyglo and Blaina Iron Works. [illegible]	[illegible]	73 - 75
73,000	10	5/-	[illegible]	10	11[illegible] 12
[illegible]	[illegible]	[illegible]	North-Eastern Steel Co., Ltd., Ord.	[illegible]	[illegible]
[illegible]	Stk	4	Do. 4½% 1st Mt. Db. Stk., Red.	100	[illegible]
[illegible]	[illegible]	2	[illegible] Co., Ltd., Ord., "B"	5	3½ - 4
[illegible]	[illegible]	[illegible]	Do. 6% Cum. Pref. "A" ..	[illegible]	[illegible]
70,000	10	6/-	[illegible] Ltd., Ord.	10	[illegible]
[illegible]	Stk	4	Do. 4% Perp. Deb. Stock	100	97 - -100
[illegible]	5	[illegible]	[illegible]	5	[illegible]
230,000	1	[illegible]	[illegible] Ltd., Ord.	1	[illegible]
[illegible]	5	2/-	Rhymney Iron Co., Ltd. ..	5	[illegible] 2
73,062	[illegible]	2/-	Do. N[illegible]	[illegible]	[illegible] 1
£330,000	[illegible]	5%	Do. *5% Mort. Deb., Red. ..	100	[illegible]
[illegible]	1	7/-	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf. ..	1	[illegible]
[illegible]	Stk	4½	Do. 4½% Perp. Deb. Stock ..	100	[illegible]
35,000	10	[illegible]	Ruston, Proctor & Co., Ltd... ..	10	[illegible]
275,000	1	[illegible]	[illegible]	1	[illegible]
[illegible]	1	7[illegible]	Do. 6% Cum Pref. ..	1	[illegible]
[illegible]	Stk	[illegible]	Do. 4% Perp. Deb. Stk	100	[illegible]
[illegible]	100	[illegible]	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red ..	100	90 — 93
[illegible]	100	[illegible]	D[illegible]	[illegible]	[illegible]
[illegible]	1	1/-	South Durham Steel & Iron, Ltd Or.	1	[illegible]
[illegible]	1	[illegible]	Do. 6% Cum. Pref...	1	[illegible]
[illegible]	Stk	[illegible]	Do. [illegible]	100	[illegible]
[illegible]	10	[illegible]	Stephenson (Robert) & Co., Ltd., O..	10	[illegible]
2[illegible]	10	5/6	Do. 5½% Cum. Pref. ..	10	3½— 4
£250,000	[illegible]	4%	Do. [illegible]	100	76 — 78
85,000	10	9/-	[illegible]	10	17½ -- 18
[illegible]	10	6/-	[illegible]	10	[illegible]
[illegible]	1	4.69d.	[illegible]	1	1
538,845	1	6d.	Do. 5% Cum. Pref.	1	1
£240,000	Stk	4½	Do. [illegible]	100	96 — 99
300,000	1	[illegible]	[illegible]	1	½— 9/16
£200,000	100	4	Do. [illegible]	[illegible]	67 — 71
£160,000	1	7½d.	[illegible]	[illegible]	[illegible]
10,000	10	5/-	[illegible]	10	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	$1000	94 — 96
[illegible]	1	1/-	[illegible]	1	[illegible]
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	[illegible]	[illegible]
£750,000	Stk	[illegible]	Do. [illegible]	[illegible]	111 -114
£1,250,000	Stk	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	100	[illegible]
[illegible]	1	[illegible]	[illegible]	1	[illegible]
[illegible]	1	7½d	Do. 6% Cum. Pref. [illegible] ..	1	[illegible]
[illegible]	Stk	4	Do. [illegible]	[illegible]	[illegible]
7,637	5	[illegible]	[illegible] Pref. 5½	[illegible]	[illegible]
[illegible]300	[illegible]	[illegible]	Do. Mort. Deb. 4½% ..	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 — 2
[illegible]	5	3/-	[illegible]	[illegible]	[illegible]
£216,641	Stk	[illegible]	[illegible]	1[illegible]	7[illegible]
[illegible]	[illegible]	[illegible]	[illegible] 4½% 1st Mort. Deb. Stk. Red	1[illegible]	[illegible]

[illegible]

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares	Last Dividend	Name	Paid up	Closing Prices
70,000	1	6d.	Alliance Elec. Co., Ltd. 5%, Cum. Pf.	1	[illegible]
12,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	[illegible]
120,000	1	9¾d.	Bell's Asbestos Co., Ltd.	1	[illegible]
100,000	5	4	British Insulated & Helsby Cables Ltd., Ord.	5	5 5¼
100,000	5	3/-	Do. 6% Cum. Pref.	5	5¾ [illegible]
£500,000	Stk	4%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101 104
£200,000	Stk	4%	British Thomson Houston Co., Ltd. 4½% 1st Mort. Deb. Stk. Red.	100	101 —103
400,000	[illegible]	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 8% Pref.	5	2[illegible] 2⅝
£616,353	Stk	4	Do. 4% Mort. Deb. Stk. Red.	100	86 88
105,731	2	[illegible]	Brush Elec. Enging. Co., Ltd., Ord.	2	⅝— ⅞
150,000	2	2/4	Do. 6% Pref.	2	1¼ 1½
£125,000	Stk	4%	Do. 4% Perp. 1st Deb. Stk.	100	93 — 96
£125,000	Stk	4%	Do. 4½% Perp. 2nd Deb. Stk.	100	73 — 76
35,000	5	5	Callender's Cable & Constn. Ltd. Ord.	5	9 — 10
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 5¼
£200,000	Stk	4	Do. 4½% 1st Mort. Deb Stk. Red.	100	104 106
85,000	3	1/6	Crompton & Co., Ltd.	3	2 2¼
£100,000		5%	Do. 5% 1st Mort. Reg. Debs.	100	93 — 98
52,000	5	10	Dick, Kerr & Co., Ltd., Ord.	5	8 8½
61,000	5	9/-	Do. 6% Cum. Pref.	5	5 6
£300,000	Stk	4½	Do. 4½% Deb. Stock, Red.	100	105 107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1¼ 1⅜
£233,334	Stk	4	Do. 1st Mort. 4% Irre. Deb. Stk	100	105 108
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	[illegible]
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1 1¼
£314,023	Stk	4	Do. 4% Deb. Stock Red.	100	78 — 83
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	79 84
112,100	2	1/7½	Electric Construction Co., Ltd.	2	1⅛ 1¼
31,390	2	2/9	Do. 7% Cumulative Pref.	2	2¼ 2½
£200,000	Stk	4	Do. 4% Perp. 1st Mt. Deb. Stk.	100	98 -100
10,248	10	7/6	Evered and Co., Ltd.	10	13 — 15
£100,000	Stk	5	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red.	100	90 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	91 96
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	10¼ 10¾
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5½ — 5⅝
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	110 —112
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.	10	15 16
£300,000	100	4%	Do. 1st Mort. Deb. Red.	100	99 -102
7,500	10		Parker, Thos., Ltd.	10	6½ 7
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	38 — 40
£150,000	100	4%	Do. 4% Deb. Bonds	100	101½ 103½

III.—ELECTRIC TRACTION.

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up	Closing Prices.
120,000	5	3/-	Anglo-Argentine Trams Co., Ld., Or.	5	8½ [illegible]
260,007	5	2/6	Do. 5% Cum. Pf.	5	[illegible]
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888	100	140 - -143
20,000	10	6	Barcelona Trams Co., Ltd., Ord.	10	12 12¼
[illegible]	10	5/-	Do. 5% Cum Pf. share	10	9 - 10
£46,300	100	[illegible]	Do. 5% Debs., Red.	100	98 101
£191,326	Stk	4½	Do. 4½% Red. Deb. Stk.	100	95 -100
[illegible]	1		Bath Elec. Trams. Ld., Pf. Or.	1	[illegible] ¾
59,394	1	11·49d.	Do. 5% Cum. Pf.	1	[illegible] 1
75,000	5		Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1½ - 2
75,000	5	2/6	Do. 5% Cum. Pf.	5	3¾ 4¼
£425,000	Stk	4½	Do. 4½% 1st Deb. Stk., Red	100	94 - -98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	100 —103
		5%	Pref. Ord. Stock	100	100 —103
7,500	10	5	Do. 5% Cum. Perp. Pf.	10	10¼ 10¾
£242,800	10	4½%	Do. 4½% 1st Mort. Debs.	40	102 104
£220,000	100	4½%	Do. 4½% Vancouver Power Db.	100	98 —101
133,501	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¾ 10¼
156,437	10	6/-	Do. 6% Cum. Pref.	10	11 11¼
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk.	100	118 —120
£250,000	Stk	4%	Do. 4% 2nd Deb. Stk. Red	100	96 98
100,000	5	1/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3⅞ 4
40,500	5	3/-	Do. "A" 6% Cum Pref.	5	5[illegible] 5⅞
27,000	5	[illegible]	Do. "B" do.	5	5⅛ 5⅜
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	94 97*

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up.	Closing Prices
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	98 101
102,268	5	3/-	Calcutta Tramways Co., Ltd.	5	8¼ 8¾
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 108
480,000	1	1/-	Cape Electric Tramways, Ltd.	1	1¼ 1[illegible]
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref	5	1⅞ [illegible]
£300,000	100	4	Do. 4% 1st Mort. Debs.	100	98 102
155,000	5	4/-	City of Buenos Ayres Trams. Co., Ld.	5	10¼ 10½
£116,000	Stk	6	Do. Per. 6% Deb. Stk.	100	140 - 145
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 —104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord.	10	13 — 14
59,987	10	6/-	Do. 6% Pref.	10	15 16
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref	5	3½ 4
£150,000	Stk	4%	Do. 4% Deb. Stock	100	88 — 91*
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10⅜ - 10⅝
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	101 - 103*
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	103 —105*
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	⅜ ½
500,000	1	6d.	Do. 5% Cum. Pref.	1	[illegible] 1
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	102 —104*
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½— 1½
110,923	8	2/9⅗	North Metropolitan Tramways Co.	8	4¼ 4¾
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90 — 95*
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red.	100	101 —104*
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8 — 9
24,500	10	5/-	Do. 5% Cum. Pref.	10	8½ 9½
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	99 —102

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
7,500	10	16/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord.	10	12 12½
7,500	10	4/6	Do. 4½% Cum. Pref.	10	9½— 10
7,500	10	6/-	Do. 6% Cum. Second Pf.	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red	100	102 —104*
14,000	5	2/-	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼ — 5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	101 —104
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord.	5	10½ 11
12,493	5	3/6	Do. 7% Cum. Pref. Shares	5	10¼ — 10¾
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord	5	8½ - 8¾
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk.	100	105 108
70,000	5	4	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord.	5	8¼ - 8¾
10,000	5		Do. do Ord.	5	8 — 8½
80,000	5	2/3	Do. do. 4½% Cum. Pref.	5	[illegible] - [illegible]
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red	100	101 —103
40,000	5	2/3	Do. do. "City Undertaking" 4½% Cum. Pref	5	4⅞ 5 1/16*
40,000	5	2/3	Do. do. do. (1903)	5	4⅞ - 5 1/16*
44,436	5	2/4	Chelsea Elec. Sply. Co., Ltd., Ord	5	6[illegible] 7
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Re	100	107 —109*
70,595	10	5/-	City of London El. Lightg. Co., Ld., O	10	11 — 11½
40,000	10	6/-	Do. 6% Cum. Pref.	10	13½ — 14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red	100	121 —125*
£300,000	Stk	4½	Do. 4½% 2nd Deb. Stk, Re	100	101 —103*
40,000	10	4/-	County of London Elec Supply Co., Ltd., Ord.	10	9 — 9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 - 12½
£400,000	Stk	4½	Do. 4½% Deb. Stk., Red.	100	107 —110*
£250,000	—	4½%	Do. 4½% 2nd Deb. Stk., Prv. Crts. all paid, Red	100	101 —103
70,000	5	4/6	Edmundson's Elec. Cor. Ltd., Or.	5	6½ — 6⅝
70,000	5	3/-	Do. 6% Cum. Pref.	5	6 — 6¼
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	107 —109
£80,000	Stk	5	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red	100	86 — 91*
12,000	5	2/-	Folkestone Elec. Supply Co., Ld., O	5	5½ — 6
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red	100	102 —105
15,000	10		Havana Electricity Co., Ltd.	10	9½—10½
13,000	5	3/6	Hove Elec. Lighting Co., Ltd., Ord	5	7½— 8
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	101—102
150,000	1		Kalgoorlie Electric Power & Lighting Corp. Ltd., 6% Cum. Pref.	1	[illegible] - 11/16
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord.	5	12½ - 13

Stocks and Shares marked * are quoted ex dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
£135,000	Stk	4 %	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 — 104
111,000	3	—	London Elec. Supply Corp., Ltd., Ord.	3	2⅜ — 2⅝
60,000	5	3/-	Do. 6% Pref.	5	5⅜ — 5⅝
£371,846	Stk	4 %	Do. 4% 1st Mort. Db. Stk., Red.	100	95 — 97
100,000	10	9/-	Metropolitan Elec. Sup. Co., Ltd., Or.	10	18 — 18½
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5¼ — 5¾
220,000	Stk	4½	Do. 4½% 1st Mort. Db. Sk., Red	100	110 — 113
250,000	Stk	3½	Do. 3½% Mort. Deb. Stk., Red	100	96 — 98
£250,000		4½	Midland Elec. Corp. for Power Distribution Ld., 4½% 1st Mort. Deb.	100	92 — 95
10,852	10	6	Notting Hill Elec. Ltg. Co., Ltd. Ord.	10	14½ — 15
£59,000	100	4 %	Do. 4% 1st Mort. Debs.	100	101 — 103
16,000	5	2/6	Oxford Electric Co., Ltd., Ord.	5	6¼ — 6¾
£75,000	Stk	4 %	Do. 4% Debenture Stk. Red.	100	99 — 101
£84,700	100	4½ %	Royal Elec. Co. (of Montreal) 4½% 1st Mort. Deb.	100	100 — 102
40,000	5	5	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13½ — 14
20,000	5	3/6	Do. 7% Pref.	5	8½ — 9
£170,000	Stk	3½	Do. 3½% Deben. Stock, Red	100	98 — 100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2¾ — 3¼
£50,000	Stk	4 %	Do. 4% Debenture Stk. Red.	100	83 — 87
65,000	5	3/-	South London Elec. Sup. Co., Ltd. O.	5	4½ — 4¾
100,000	1		South Metropolitan Elec. Light & Power Co., Ltd. Ord.	1	
40,000	1	8½d.	Do. 7% Cum. Pref.	1	1⅛ — 1⅜
£100,000	Stk	4½ %	Do. 4½% 1st Deb. Stock Red.	100	107 — 110
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	5 — 5½
30,000	5	2/6	Do. 5% Cum. Pref.	5	5⅛ — 5⅝
£200,000	Stk	4½	Do. 4½% 1st Mort. Deb. Stk. Red.	100	104 — 106
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12¾ — 13¼
28,151	5	2/6	Do. 5% Cum. Pref.	5	6¼ — 6¾

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
£34,800	100	4 %	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red. ..	100	99 — 102
25,000	10		Amazon Telegraph Co., Ld. ..	10	½ — 1
£763,580	Stk	12/6	Anglo-American Tel. Co., Ltd., Ord.	100	57 — 59
£3,118,210	Stk	25/-	Do. 6% Preferred Ordinary	100	103½ — 104½
£3,118,210	Stk	2	Do. Deferred Ordinary .	100	13¼ — 13¾
44,000	5	4/-	Chili Telephone Co., Ltd.	5	5½ — 6½
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	170 — 190
£1,[illegible]	Stk	4 %	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	92 — 94
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8 — 9
6,000	10	10/-	Do. 10% Preference	10	16½ — 17½
6,000	5	2	Direct Spanish Telegraph Co., Ord.	5	3¼ — 3¾
			Do. 10% Cum. Preference	5	7¼ — 8
£[illegible]	50	4½	Do. 4½% Debs.	50	100-102% *
60,710	20	3/-	Direct U.S. Cable Co., Ltd.	20	10¾ — 11
£85,800	100	4 %	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	99 — 101
£300,000	100	4 %	East. & S. African, Ld., 4% Mt. Db.	100	101 — 103
£[illegible]	25	4 %	Do. 4% Reg. Mt. Dbs. Mauritius Subsidy	25	100-102%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd.	10	13¾ — 14
£[illegible]	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	104 — 108
£3,000,000	Stk	2½	Eastern Tele. Co., Ltd., Ord.	100	135 — 138
£2,000,000	Stk	17/6	Do. 3½% Pref. ..	100	88 — 90
£1,[illegible]	Stk	4%	Do. 4% Mort. Deb. ..	100	105 — 107
150,000	10	[illegible]	Great Northern Telegraph Co., Ltd. (Copenhagen)	10	28½ — 29
£58,700	100	4½	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	99 — 101
17,000	25	12/6	Indo-European Telegraph Co., Ltd.	25	44½ — [illegible]
72,680	1	7	Monte Video Telephone Co., Ltd., O.	1	¼ — [illegible]
£1,[illegible]	Stk	6	National Telephone Co., Ltd. Pref.	100	108 — 110
£1,966,667	Stk	5	Do. Deferred .	100	107 — 109
15,000	10	6/-	Do. 6% Cum. 1st Pref.	10	13 — 15
15,000	10	6	Do. do. 2nd do.	10	12 — 13
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	[illegible]
£2,000,000	Stk	3½	Do. 3½% Deb. Stk., Red. ..	100	[illegible] — 98
£[illegible]	Stk	4	Do. 4% do. do.	100	[illegible]
£1,000,000	—	[illegible]	Do. 4% Prov. Certs. all paid.		101½ - 103½
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1 — 1⅛
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1⅛ — 1¼
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red. ..	100	96 — 99
11,839	8	4/-	Reuter's Telegram Co., Ltd.	8	7 — 7½
58,000	5	3	United River Plate Telep. Co., Ltd.	5	5½ — 6
40,000	5	2/6	Do. 5% Cum. Pref. ..	5	5 — 5¼
£179,947	Stk	5%	Do. 5% Deb. Stock, Red.	100	104 — 106
15,609	10	1/-	W. African Telegraph Co., Ltd. ..	10	7¼ — 7¾

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
£30,008	2½	—	West Coast of America, Ltd. .	2	¼ — [illegible]
150,000	100	4 %	Do. 4% Deb. Guar. by West. Tel.	100	97 — 99
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	⅝ — ⅞
34,563	10	6/-	Do. 6% Cum. 1st Pref.	10	7 — 7½
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	6 — 7¼
£80,000	100	5 %	Do. 5% Deb.	100	101 — 103
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13⅞ — 14
£75,000	100	5 %	Do. 5% Debs., 2nd Series, 1906	100	100 — 103*
518,945	Stk	4 %	Do. 4% Deb. Stock, Red.	100	100 — 102

VI.—SHIPPING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8½ — 9
£350,000	Stk	4½ %	Do. 4½% Red. 1st Mort. Deb. Stk.	100	98 — 100
£672,900	Stk	4½	British & African Stm. Nav. (1900), Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	91 — 93
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6 — 7
£600,000	Stk	4½ %	Do. 4½% 1st Mort. Deb. Stk.	100	73 — 76
£750,000	Stk	4½	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	98 — 100
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000 ..	20	13 — 13½
40,000	20	8/-	Do. Nos. 60001-100,000	10	5¾ — 6¼
£451,430	Stk	4½ %	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	100 — 102
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord.	1	1 — 1⅛
30,000	10	5/-	Do. 5% Cum Pref. .	10	9¾ — 10¼
327,300	100	4½	Do. 4½% 1st Mort Debs. Red.	100	105 — 107
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	1¼ — 1¾
35,758	8	4/9	Do. Non-Cum. 6% Pref.	8	7¼ — 7¾
£150,000	Stk	4 %	Do. 4% 1st Mort Deb Stk. Red	100	95 — 97
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	3 — 3½
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3¼ — 3¾
£200,000	Stk	4½ %	Do. 4½% 1st Mt. Deb. Stk. Red.	100	83 — 86
141,500	10	5/-	Leyland (Fredk.), & Co. (1900), Ltd., 5% Cum Pref. ..	10	5¼ — 5¾
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	126 — 129
£1,160,000	Stk	19 %	Do. do. Deferred ..	100	216 — 219
£800,000	Stk	3½ %	Do. do. 3½% Deb. Stock ..	100	99 — 101
£648,100	Stk	3½ %	Do. do. 3½% 2nd Deb. Stk.	100	96 — 98
15,000	100	30/-	Royal Mail Steam Packet Co. Ord. .	60	25 — 26
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref. ..	5	4¾ — 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord. ..	10	8 — 8½
24,000	10	4/6	Do. 10% Cum. Pref. . ..	10	9½ — 10
£1,008,840	Stk	4 %	Do. 4% Debenture Stk., Red	100	99 — 101*

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name.	Paid up	Closing Prices.
60,000	1	9⅜d.	Chadburn's (Ship Tele.) Ltd., Ord.	1	1 — 1⅛
£750,000	Stk	5 %	General Hydraulic Power Co., Ltd	100	136 — 141
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord.	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pref.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos 66 463 250	15/-	[illegible]
66,462	1	8·4d.	Do. do. Nos. 1-66,462	1	[illegible]
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1⅛ — 1¼
135,000	1	7½d.	Do. 6% Cum. Pref.	1	1⅛ — 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

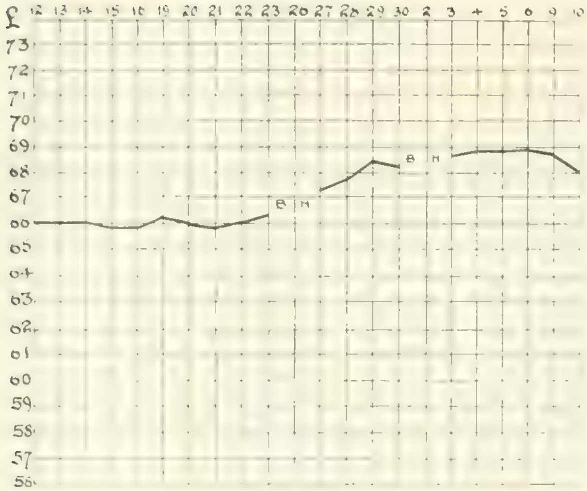
Present Amount Subscribed	Shares	Last Dividend	Name.	Paid up.	Closing Prices
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	21 — 21½
8,739	10	3/-	Do. Second Issue 1-8,739	4	5 — 5½
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000	10	13 — 13½
49,111	7	7/-	Gloucester Rail. Car. & Wagon, Ltd., A, 1-29,861 & 49,751-50,000	7	8½ — 9
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-74,000	7	4½ — 4¾
781,808	1	9d.	Metropolitan Amalgamated Rail. Carriage & Wagon Ld., 1-781,808	1	[illegible] — 19/6
164,288	1	6d.	Do. Cum. A Pref. 5%, 1-164,288	1	24/- — 25/-
235,000	1	7½d.	Do. Cum. B Pref. 6%, 1-235,000	1	28/- — 28/6
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	19 — 19½
10,000	20	7½d.	Do. Pref. 6 per cent. 1-10,000		[illegible]

Stocks and Shares marked * are quoted ex-dividend.

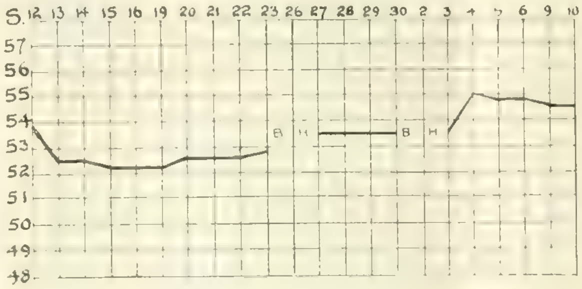
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM DECEMBER 12TH, 1904, TO JANUARY 10TH, 1905.

COPPER.



PIG IRON: SCOTCH



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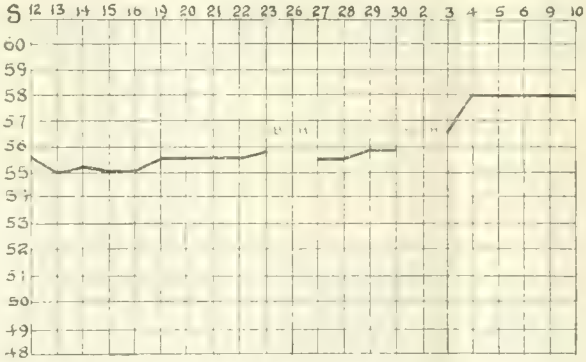
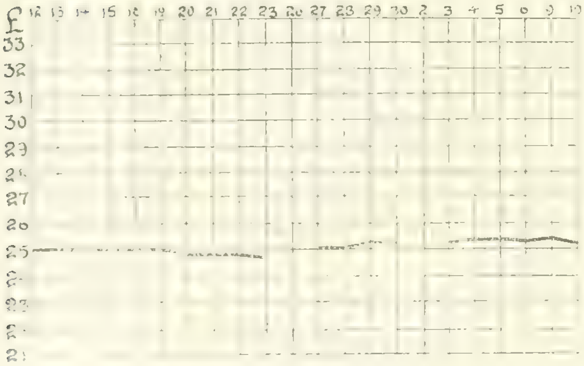
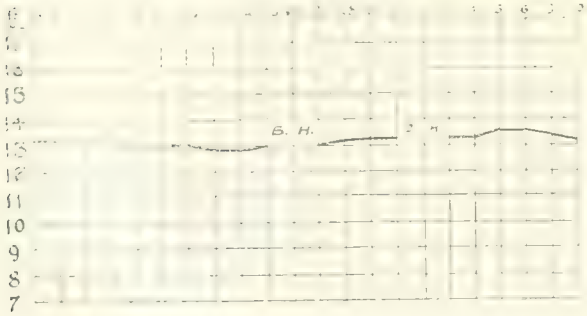


SPELTER.



ENGLISH LEAD.



THE LIEGE ASSOCIATION OF ENGINEERS.

The current issue of the bulletin of this Association, the leading engineering society in Belgium, now numbering 1,375 members, is devoted chiefly to a report of the visit to London in September last under the auspices of the Iron and Steel Institute. The Belgian visitors express their appreciation in enthusiastic terms of their reception at the National Physical Laboratory at Teddington, at the Italian Exhibition, at the installations of the Temperley transporters, at the Machinery collection of the South Kensington Museum, and at the works of Messrs. Fraser and Chalmers at Erith. It is notified that, as an outcome of the visit, Mr. Carnegie, the president of the Iron and Steel Institute, and Mr. E. Windsor Richards, past-president, who presided at the banquet offered to the Belgian visitors at the Hotel Cecil, have been elected honorary members of the Association.

PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, January 11th, 1905.

COPPER opened the year with a strong market and remains active and buoyant. The home trade is good, the Continent has been a heavy buyer and consumption in the United States is steadily increasing. As a result it has been a little difficult to buy except for forward delivery, and those who desired to fill early requirements, have had to concede the higher prices asked. The strong appearance of the metal has been reflected in the speculative market, and the quotation has been firm at about £69. The position appears to justify higher values, although yesterday the price receded.

Tin, after a short spell of depression, has exhibited symptoms of recovery, the scarcity of spot metal on the market having induced speculative operations for the rise. Messrs. Merton and Co.'s statistics for the past month show a decrease of 721 tons, excluding America. The closing price yesterday was, however, lower at £130 10s. cash, £130 15s. three months.

In the Iron and Steel Market there is little or nothing fresh to record. Pig iron has been firm without much business passing, and finished iron and steel has been active. The reports from industrial centres are fairly encouraging, and the trade outlook is tolerably bright. The new contract for standard iron is now in force and many dealings have taken place under it. The statistics of Scotch pig iron for 1904 show that production increased 51,667 tons and consumption increased 97,864 tons. Exports were lower and stocks show an increase of 27,356 tons. Messrs. Merton and Co.'s circular gives the stock of Middlesbrough iron at 192,021 tons.

In the Lead Market there has been a good speculative demand, and with holders rather unwilling to sell at ruling quotations an improvement in values has to be recorded.

Spelter is rather harder, owing to the large demand for galvanised iron, consumers still buying against sales of the manufactured article. Producers are all well sold for months to come.

In the Coal section large steam has been unusually active during the past week, and prices have stiffened appreciably all round. The small coal department is good for prompt delivery, and house coal is rather firmer.

In the Shellac Market things are inclined to quiet down.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

	£	s.	d.
Steel :			
Siemens' Steel Plates, Marine Boiler Quality	6	15	0
,, ,, ,, Land ,, ,, ...	6	17	6
,, ,, ,, Ship Quality Plates	5	15	0
Siemens' Steel Bars, Boiler Quality	6	15	0
,, ,, ,, Ship ,,	6	5	0
,, ,, Angles	5	5	0
Manufactured Iron :			
Bars Dalzell ...	6	2	6
,, Best	6	12	6
,, ,, Horseshoe	6	12	6
,, Angle	6	2	6
,, Best Angle	6	12	6
,, Best Best	7	2	6
,, Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal) :

	£	s.	d.	
Steel Angles (Glasgow ♛ Steel)	5	5	0	per ton.
Steel Ship Plates (Glasgow ♛ Steel)	5	15	0	,,
Steel Bars, Ship Quality (Glasgow ♛ Steel)	6	5	0	,,
Steel Bars, Boiler Quality (Glasgow ♛ ♛ Steel)	6	15	0	,,
Steel Land Boiler Plates (Glasgow ♛ ♛ Steel)	6	5	0	,,
Steel Marine Boiler Plates (Glasgow ♛ ♛ Steel)	6	5	0	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quotes :—

	£	s.	d.
Bars Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
Extra Best..	7	15	0
Best Horse Shoe	6	15	0
Extra B.H.S.	7	15	0
Extra Best Cable	8	5	0
Rivet	6	5	0
Best Scrap Rivet	7	5	0

	£	s.	d.
Angles Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix			
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan 5 per cent discount cash monthly

Messrs. R. Feldtmann and Co., of Glasgow, quote (Commission extra)

Pig Iron:	No. 1.			No. 3.		
	£	s.	d.	£	s.	d
Coltness, f.a.s. Glasgow	3	5	0	2	15	0
Gartsherrie	2	19	6	2	14	6
Summerlee	2	19	0	2	14	0
Carnbroe	2	15	0	2	13	0
Langloan	3	4	0	2	15	0
Calder	2	19	0	2	14	6
Clyde	2	19	0	2	14	6
Glengarnock, f.o.b. Ardrossan	2	19	0	2	13	6
Eglinton	2	15	0	2	13	0
Dalmellington, ,, Ayr	2	15	0	2	13	0
Shotts ,, Leith	2	19	0	2	14	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works**:—

	£	s.	d.
W.W. ♔ Bars	6	7	6
W.W. Best Bars	6	17	6
W.W. Best Best	7	7	6
W.W. Best Best Best	7	17	6
W.W. Best Shoe	6	17	6
Thornaby ♔	7	17	6
Thornaby Best	8	7	6
Thornaby Best Best	9	7	6
Whitwell Special Admiralty Cable	10	0	0
Special Chain Iron	9	0	0
Tube and Nail Strips	6	10	0
W.W. ♔ Angle Iron	6	10	0
W.W. Best Angle Iron	7	0	0
Tee Iron, to 8-inches United	7	7	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

	Iron.			Steel.		
	£	s.	d.	£	s.	d.
Crown (BNF) Bars	6	10	0	7	0	0
,, ,, Angles	7	0	0	7	10	0
,, ,, Tees	7	10	0	8	0	0
,, (WIW) Hoops	7	0	0	7	10	0
,, ,, Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in by 36in. per ton.			Doubles 21 G to 24 G 96in. by 36in per ton.		
Black Sheets:	£	s.	d.	£	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B"	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:						
	£	s.	d	£	s.	d
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

	Singles 20 G to 108 by 36in. per ton.			Doubles 21 to 24 G to 96 by 36in per ton.		
Tinned Sheets:	£	s.	d.	£	s.	d.
Best Coke (Finish)	28	0	0	29	10	0
,, Charcoal (Finish)	30	0	0	31	10	0
Extra ,, ,,	32	0	0	33	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works less 2½% for cash monthly, 10th inst.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	15	0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	7	6	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	15	0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	..
,, ,, Best Best	9	5	0	..
,, ,, Treble	10	5	0	..
Plates	7	10	0	..
Best Plates	8	0	0	..
,, Boiler Plates	8	10	0	..
,, Best Boiler Plates	9	10	0	..
Treble Best Boiler Plates	12	0	0	..

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts –

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis :—

2 tons 9/3 per cwt.
4 cwt. lots and upwards 9/6 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/- per cwt.
4 cwt. lots 8/3 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote :—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "EV"	0	13	0
C 20 by 10 225s. 155 ,, "Jumbo"	0	18	3
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	6
C 28 by 20 112s. 216 ,, "Lydbrook"	1	5	3
Charcoal Tinplates :			
C 20 by 14 112s. 108 lb. "Alloway"	0	1[illegible]	3

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes :—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

		£	s.	d	
Steel:					
Blooms	at	3	12	0	per ton.
Billets	at	3	14	0	..
Sheet Bars	at	3	16	0	..
Finished Steel:					
Bars	at	4	17	6	per ton.
Angles	at	4	18	6	..
Tees	at	5	0	0	..
Joists	at	4	10	0	..
Fencing Standards	at	5	1	0	..
Shoeing Bars	at	5	2	0	..
Tyre Bars	at	5	4	0	..
Half-Round Bars	at	5	5	0	..
Heavy Rails	at	4	10	0	..
Light Rails	at	4	17	6	..

Structural Steelwork :

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote :—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1½ & 1	132	0	0	to	132	10	0	per ton
English Bars, f.o.b. Dis. 1½ & 1	133	0	0	to	133	10	0	
Straits G.M.B., cash Warehouse, Net	131	10	0	to	131	15	0	
Straits G.M.B., 3 months, Warehouse, Net	130	15	0	to	131	0	0	
Australian, Mr. Bischoff, Warehouse, Net	132	0	0	to	132	5	0	

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	68	7	6	to	68	10	0	per ton.
Standard G.M.B., 3 months, Warehouse, Net	68	15	0	to	68	17	6	
English, Tough, Cake & Ingot, Warehouses, Net	71	5	0	to	71	15	0	..
English, Best Select, Warehouse Net	72	10	0	to	73	0	0	
English, Sheets and Sheathing, f.o.b., Dis. 2½	79	0	0	to	79	10	0	
English, Sheets for India, f.o.b., Dis. 2½%,	76	0	0	to	76	10	0	
Electro, Warehouse, Net	70	0	0	to	70	10	0	..
Ore, ex ship	0	12	0	to	0	13	0	per unit
Regulus, Matte and Precipitate, ex. ship,	0	13	3	to	0	14	0	..

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6¾	per lb
Sheathing	0	0	6⅞	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	25	2	6	to	25	5	0	per ton.
Blende of 50%, Net	7	0	0	to	7	10	0	..
Calamine, Net	7	2	6	to	7	12	6	..

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	13	2	6	to	13	5	0	per ton.
Spanish, ex ship, Dis. 2½%	13	0	0	to	13	2	6	
Lead Ore of 70%, Net	9	12	6	to	9	15	0	

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½	37	0	0	to	38	0	0	per ton
Ore, 50%, ex ship, Dis. 2½%	8	0	0	to	9	0	0	..
Crude, ex ship, Dis. 2½%	13	10	0	to	14	0	0	..

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	15	0	per flask
Italian	7	14	0	..

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage:—

Upper Main Seam.

	s.	d.
Main Coal	7	6
Best Hard Steam (hand picked, as used by the Railway Companies)	6	0
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:

	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3¼)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (¾ to [illegible])	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:

	s.	d.
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1″ to 2″)	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

STEAM	s.	d.
Best Hand Picked Hard	9	0
Steam Hard	7	9
Hard Nuts	7	0

Gedling Colliery.

HIGH HAZEL.		
London Brights, 4 to 8 in. cube	12	0
Large Nuts, 2 to 4 in. cube	9	6
Small Nuts, ¾ to 2 in. cube	5	6
STEAM TOP HARD		
Best Hard	9	0
Hard Steam	8	0
Cobbles	7	0

CHEMICALS AND OILS.

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb
Picric, Crystals	0	0	11	,,
Tartaric at Manchester	0	0	10⅞	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	8	5	0	per ton.
Grey ,,	11	0	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3¾	per lb.
Muriate Grey f.o.b. Liverpool	24	0	0	per ton.
Sal-ammoniac, Lump, 1sts, deld. U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate f.o.b. Liverpool	12	15	0	,,
Arsenic: Best White Powdered net	12	0	0	,,
Bleaching Powder, 35% ,,	1	2	6	,,
Borax: British Refined Crystal ,,	12	0	0	,,

Coal Tar Products:

	£	s.	d.	
Benzole, 50 90 %	0	0	8	per gal.
,, 90% ,,	0	0	9½	,,
Carbolic Acid Crystals, 34 35° C. ,,	0	0	6⅞	per lb.
,, ,, ,, 39/40° C. ,,	0	0	7⅛	,,
,, ,, Liquid, 97 99 % ,,	0	0	9	per gal.
,, ,, Crude, 62½%, at 60 F. f.o.b. ,,	0	2	2	,,
Creosote, ordinary good liquid ,,	0	0	1¼	,,
Naphtha, Crude, 20 % at 120° C. ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b ,,	0	0	8½	,,
,, ,, 95 % at 160° C. ,, ,,	0	0	9½	,,
,, ,, 90 % at 190° C. ,, ,,	0	0	10½	,,
,, Rectified, flash point over 73° F. f.o.b. ,,	0	0	11	,,
,, Rectified, flash point over 100° F. f.o.b. ,,	0	1	0	,,
Naphthalene, all qualities.				
Pitch f.a.s. Manchester. ,,	1	13	0	per ton.
Copperas: Green, in bulk ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	19	0	,,
Cake ,,	1	2	6	,,
Copper: Sulphate	23	0	0	,,
Cyanides: 98% minimum f.o.b. net	0	0	8	per lb.
Lead: Acetate (Sugar) White, English	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K	24	5	0	,,
,, ,, Grey	21	0	0	,,
,, ,, Brown at Manchester	16	10	0	,,
Nitrate	23	0	0	,,
Litharge, Flake	15	10	0	,,
,, Powder	16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
White ,, ,, Dry ,, ,, ,,	16	15	0	,,
Naphtha (Wood): Miscible, 60 o.p.	0	2	10	per gal.
Solvent	0	2	7	,,
Potash: Bichromate... delivered England	0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull	18	0	0	per ton.
Caustic, 75/80 % ,, ,,	20	10	0	,,
Chlorate net	0	0	3$\frac{1}{16}$	per lb.
Montreal in Store, Liverpool	35	0	0	per ton.
Prussiate, Yellow net	0	0	4$\frac{15}{16}$	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary ... ,,	5	5	0	per ton.
	,, ,, ,, Refined... .. ,,	6	5	0	,,
	,, Carbonated, 48 ..	5	10	0	,,
	,, ,, 58 ,, (Ammonia Alkali) net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 net	6	10	0	,,
	Caustic, White, 77 %............... ,,	10	10	0	,,
	,, ,, 70 ,, ...	9	12	6	,,
	,, ,, 60 ,,	8	12	6	,,
	,, Cream, 60 %..... .. .. ,,	8	10	0	
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	
	Acetate .... c.i.f. Hull net	16	10	0	,,
	Bicarbonate, in 1 cwt. kegs............	6	15	0	,,
	Bichromate......delivered England...	0	0	2¼	per lb.
	Chlorate .... net	0	0	3 1/16	per lb.
	Nitrate...ex quay Liverpool	11	0	0	per ton.
	Phosphate	9	5	0	,,
	Prussiate .... .net	0	0	3⅜	per lb.
	Silicate, Solution, 140 Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts)...............	1	12	6	,,
	,, (Saltcake), 95	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers....	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,

MINERALS.

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports	3	7	6	,,
Manganese:	Lump c.i.f. Liverpool 10½d.	per metallic unit.			
Ochre:	French JC .... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk).........c.i.f. Liverpool	3	10	0	,,

OILS, etc.

		£	s.	d.	
Aniline Oil	....................................net	0	0	4¾	per lb.
,, **Salt**	.... ,,	0	0	4½	,,
Castor Oil:	French, 1st pressure, f.o.b. Marseilles less 1½	20	0	0	per ton.
	English, 1st pressure, f.o.r. Hull, less 2½	21	15	0	,,
Cocoa Nut Oil:	Ceylon, ex store Manchester net	31	10	0	,,
	Cochin, ex store Manchester . ...net	33	0	0	,,
Cotton Seed Oil:	Refined at Hull, less 2½ naked	14	17	6	
	Edible...at Hull, less 2½ naked ...	15	7	6	
Glycerine:	Crude, 80% ....net	31	0	0	,,
Linseed Oil:	Raw at Hull, less 2½ naked	13	10	0	,,
	Boiled......at Hull less 2½% naked	14	10	0	,,
Starch:	American Pearl...at Manchester, net	9	0	0	,,
	Dextrine	18	0	0	,,
	Farina . ... ,,	15	15	0	
Shellac:	Standard TN orange spot	165/-			per cwt.
	March delivery	145/-			,,
Turpentine:	American.........at Liverpool	38	10	0	per ton.
	Russian ....at Huil...net	18	10	0	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	0
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average		0	2	3		0	3	[illegible]
Lower Ports Pine		0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	0
Quebec Oak, 1st quality ..	,,	0	2	9		0	3	3
Quebec Oak, 2nd quality	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm ..		0	3	0		0	3	[illegible]
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	[illegible]
St. John Birch		0	1	6		0	2	0
Birch Planks		0	0	9		0	0	11
Spruce Spars		0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	6	10	0		6	15	0
Lower Ports Spruce..	,,	6	0	0		6	10	0
Spruce Boards.................	,,	5	10	0		6	0	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn .	per cub. ft.	0	1	3	to	0	1	8
Sawn .	,,	0	0	10		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak	per load	12	0	0		15	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	9	to	0	2	3
Dantzic and Memel Fir, Crown . .		0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish........		0	1	2		0	1	4
Riga Whitewood		0	1	3		0	1	6
Norway Mining Timber		0	0	9		0	0	10
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars.............		0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std	19	0	0		21	0	0
Red Archangel and Onega, 2nd quality . .		16	0	0		17	0	0
Red Archangel and Onega, 3rd quality		12	10	0		15	0	0
St. Petersburg, 1st quality...		16	0	0		17	10	0
Do. 2nd ,, ...		14	0	0		15	0	0
Gefle . .		14	0	0		17	10	0
Wyburg		12	0	0		13	10	0
Uleaborg		12	0	0		13	10	0
Gothenburg . .	.	14	0	0		17	10	0

SELECTED PATENTS.

Compiled expressly for this Journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in italics.

28,310. T. H. C. Homersham, Bradford. Dec. 27th.—Improvements in and relating to syphon lubricators.

28,318. G. W. Deakin, Wolverhampton. Dec. 27th.—[illegible] differential pump.

28,319. T. Taylor, Manchester Dec. 27th.—Improvements in steam boilers.

28,335. E. MacKay, Glasgow. Dec. 27th.—Improvements in engine indicators.

28,338. R. A. Griffiths and H. Mills, Handsworth. Dec. 27th.—Improvements in means for lubricating revolving shafts and spindles.

28,339. F. W. Hampshire, Derby. Dec. 27th.—Improved valves in connection with machines for delivering measured quantities of materials.

28,353. F. W. Hurd, Glasgow Dec. 27th. Impvovements in coal-cutting machinery.

28,365. J. Harrop, Manchester. Dec. 27th.—Improved means for securing wheels to axles.

28,379. C. Bergmann, London. Dec. 27th. An improved casing for vertical shafts or spindles.

28,387. J. Coulter, London. Dec. 27th.—Improvement in automatic screw cutting and turning lathes.

28,388. J. C. Parker, London. Dec. 27th. Improvements in steam generators.

28,390. E. S. Bond, Birmingham. Dec. 27th.—Improvements in transmission gear for high-speed engines.

28,401. F. C. Keith, London. Dec. 27th. Improvements in rotary engines.

28,411. C. Bennett, Birmingham. Dec. 27th.—Improved means for propelling ships.

28,418. A. W. Death, Leicester. Dec. 27th. -Improvements in stop valves.

28,449. J. Wilkinson, London. Dec. 27th.—Governing mechanism for turbines. (Date applied for, Feb. 23rd, 1904.)

28,450. J. Wilkinson, London. Dec. 27th.--Improvements in elastic fluid turbines. (Date applied for, Mar. 4th, 1904.)

28,451. J. Wilkinson, London. Dec 27th.—Improvements in and in connection with the stuffing boxes for turbine shafts. (Date applied for, Mar. 5th, 1904.)

28,452. J. Wilkinson, London. Dec. 27th.—Governing mechanism for turbines. (Date applied for, Jan. 25th, 1904.)

28,463. B. J. B. Mills, London. Dec 27th.—An automatic [illegible] valve. (*Tony Blum and F. [illegible], France.*)

28,469. F. Mitchell and H. H. P. Seabrook, London. Dec. 27th.—Improvements in and relating to variable speed gears.

28,472. D. Mills, London. Dec. 27th. Improvements in [illegible]

28,475. E. E. Taylor, London. Dec. 27th. -Improvements in and relating to mechanical underfeed stokers.

28,477. L. E. Cowey, London. Dec. 27th. -Improvements in and relating to apparatus for indicating or recording speed.

28,485. P. R. J. Willis, Kingston-on-Thames. Dec. 27th Improvements in [illegible] steering gear. (*F. [illegible]*)

28,530. T. K. North, London. Dec. 28th. Improvements in boilers for the generation of steam.

28,538. A. A. C. Suggate, Manchester. Dec. 28th. An improved stress-strain indicator.

28,539. E Decauville, London. Dec. 28th.- An improved combined autoclave and hydraulic press. (Date applied for, Sept. 10th, 1904.)

28,541. T. G. Thompson, London. Dec. 28th.—Improvements in propellers. (Date applied for, Feb. 11th, 1904.)

28,557. A. E. Bringemann, Sutton. Dec. 28th.—Economic crankless engine to be driven by compressed air, or by steam, or by a stored force, created by explosion.

28,571. The Warwich Machinery Company, Ltd., and F. Samuelson, London. Dec 28th.—Improvements in and relating to steam turbines.

28,582 T. Delville, and E. Mennig, London. Dec 28th.—Means and apparatus for effecting the supply and exhaust of steam to and from steam engines working with slide valves.

28,625. E. P. A. Villette, London. Dec. 28th.—An improved system for rapidly stopping vessels travelling at full speed.

28,627. W P Thompson, London Dec 28th. Improvements relating to turbine engines driven by combustible gases. (*E. Uhlenhuth, France.*)

28,681. J. Sharp, Glasgow. Dec 29th.—Improvements in and relating to rotary exhausters and applicable to pumps or engines.

28,699. The Expansion Turbine Syndicate Ltd., and H. A. Buck, London. Dec 29th. Improvements in or relating to fluid pressure turbines or rotary engines.

28,761. G. R. Sisterson and G. Mitchell, London. Dec 29th—Improvements in connection with cylinders and valves for locomotive and other engines.

28,768. P. Holtzmann, London. Dec 29th. Improvements in removable seats for pump valves.

28,771. F. J. Cole, London. Dec 29th.—Improvements in steam boilers, superheaters.

28,772. F. J. Cole, London. Dec 29th Improvements in steam boiler superheaters.

RECENT SPECIFICATIONS.

VALVES.

J. Hopkinson and Co., Ltd., J. Hopkinson, and R. Kilburn, Huddersfield. May 28th, 1904.—Refers to improvements in the prior patent, No. 27798/1903, wherein is described a screw down stop valve of the mushroom type, in which two valves are used, working in opposite directions and arranged on opposite sides of a seating-floor or partition. Said valves are connected together through their actuating mechanism, and are arranged to close on to the seating-floor from opposite sides thereof, and to nip said floor when closed, without straining the valve casing or bringing one-sided pressure to bear on the seating-floor by the closing means. In carrying out that invention we employed for one of the valves a tubular spindle connected to a bridge having a limited movement on fixed guides, the spindle of the other valve being arranged to pass through the aforesaid tubular spindle, and being connected to the bridge by a screw-threaded sleeve. In this construction, therefore, the connections are concentric. Now, according to the present invention, the same arrangement is employed for nipping the seating floor, but the concentric arrangement of spindles is dispensed with, and in lieu thereof, the valve spindles are passed out in opposite directions through lids on opposite sides of the casing so that no spindle passes through the thoroughfare in the partition as heretofore, and the spindles are actuated by connected gearing or by connected levers or rods and screw mechanism.

STEAM TRAP UNION.

Lancaster and Tonge, Ltd., and J. Butterworth, Pendleton, Manchester. [illegible] In [illegible] prevent [illegible] matter entering the [illegible] damaged [illegible] [illegible] interposed [illegible]

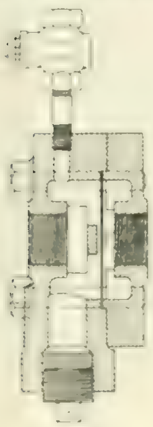


FIG. 2.

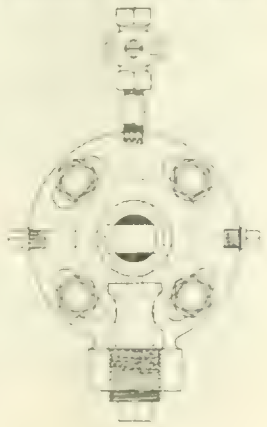


FIG. I.

[illegible] to compensate [illegible] in the edge [illegible] of the union as well as in the centre [illegible] the drain pipe arrangement. Also by shifting one half of the union on the other, the inlet in the edge can be made to take up four different positions at right angles to [illegible]

PRESSURE GAUGES.

Schaffer and Budenberg, Ltd., Manchester (communi- [illegible]

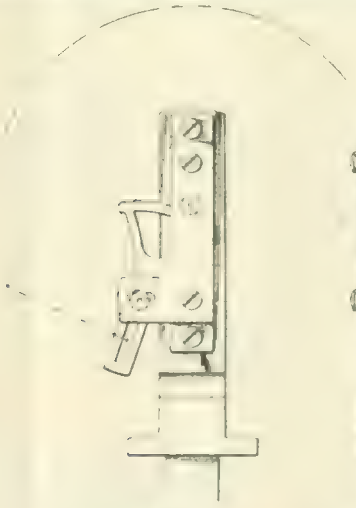


FIG. 1.

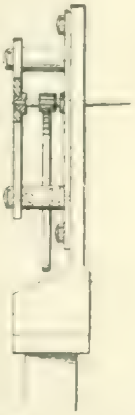


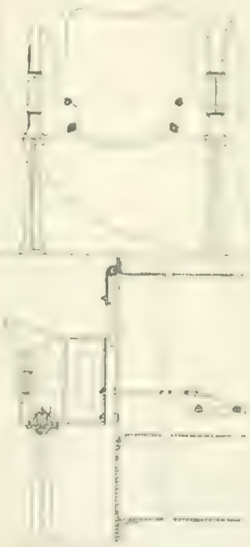
FIG. 2.

[illegible] wear and tear which has hitherto taken place between the quadrant [illegible]

diminished. The frame, bracket or the like which are to support the [illegible] of sufficient thickness to possess the required structural strength, and is furnished at the proper point with a bush or bushes or liner of nickel, bronze, or other suitable bearing metal, secured in place within the stamping and bored to the required size, to form a bearing for the [illegible] be formed in any desired manner, and are conveniently punched out at the same time as the stamping, these bushes are secured in place by [illegible]

MECHANICAL STOKERS.

John Vicars, Thomas Vicars, and John Vicars, of Earleston, Lancs. [illegible] the stokers may be readily attached to, or detached from, a boiler, while a tight joint is always maintained between the stoker frame and the [illegible] expansion of the boiler. The back part of the stoker frame is provided with studs and set bolts adjustable in slots. These studs rest upon the furnace rings, or on the edges of the openings in the front plate of the boiler and support the weight of the back part of the stoker at this point. To keep the stoker frame closely in contact with the boiler



FIGS. 1 AND 2.

[illegible] holes in the front plate of the boiler for securing the stoker frame to. The front parts of the stoker frames are provided with slides which rest upon guides in uprights secured to the ground. The uprights have bolts which pass through slots in the stoker frames so that such frames are firmly secured to the uprights while allowing of longitudinal motion. At the same time these uprights support the greatest part of [illegible] front.

CALENDARS.

From Messrs. W. H. Willcox and Co., Ltd., of 23, Southwark Street, S.E., we have received a "date [illegible] for 1905, printed in two colours and suitable for hanging on the wall.

A substantial wall calendar received from Messrs. R. Y. Pickering and Co., Ltd., of Wishaw, [illegible] calls attention to their railway motor carriages, samples of rolling stock, etc.

Messrs. Robert A. Thompson and Co., Ltd., Colonial publishers, wholesale exporters and importers of periodicals, of 5, Tudor Street, E.C., have issued an artistic card calendar printed in silver and blue on a dark red ground.

NEW PUBLICATIONS.

"THE METRIC FALLACY."

By Frederick A. Halsey, and "The Metric Failure in the Textile Industry." By Samuel S. Dale. D. Van Nostrand Company, New York. E. and F. N. Spon. 4s. 6d. net.

This emphatic protest against the introduction of the Metric system is the outgrowth of a paper presented about two years ago to the American Society of Mechanical Engineers. Without entering into any species of partisanship we cannot avoid admiring the vigour and enthusiasm with which the writers attack their subjects. They remark that Anglo-Saxon nations are the only ones that have ever dealt with the subject of weights and measures in a rational manner, and "with their system of weights and measures as a foundation, the English-speaking people have built up the greatest commercial and industrial structure the world has known. This system they are asked to abandon for the benefit of others at a cost that is beyond estimate, and for compensating advantages that to themselves are wholly trivial and imaginary." Among others the work aims at establishing the following propositions: That as shown by the experience of other countries, the changing of a nation's system of weights and measures is a task of enormous difficulty, and is attended by widespread confusion; the adoption of the metric system involves the destruction of all mechanical standards; and that the prosperity of foreign trade in nowise requires the adoption of the system as a basis of manufacture.

"ALTERNATING CURRENTS."

By Alexander Russell, M.A., M.I.E.E. Volume I. Cambridge Physical Series, C. J. Clay and Sons. 12s. net.

The desirability of collecting together and examining the mathematical theorems which electricians constantly utilise, has been accentuated by the rapid advancement that has been made in the application of alternative currents to industrial purposes. In this connection, Mr. Russell's work when completed, should prove invaluable to the working electrician or the advanced student; the present volume opens with a résumé of the theorems and formulæ in the sciences of electro-statics, electro-dynamics, and magnetism; then follow a few chapters dealing with induction and capacity, and the methods by means of which the capacities of polyphase cables and overhead wire can be calculated. Other sections of the work deal with the test room methods of measuring power; some problems in two phase theory, demonstrating how the theorems of solid geometry can be applied in this case; the main problems in the theory of phase indicators and induction type watt-hour meters are stated and approximate solutions are given. Succeeding chapters are devoted to, Rotating Magnetic Fields, Gilding Magnetic Fields; the Magnetic Field round Polyphase Cables, Losses in Single Phase and Three Phase Cables; Eddy Current Losses, and the Method of Duality. The book is well illustrated.

BOOKS RECEIVED.

The Commission of H.M.S. *Fox*, East Indies Station, 1901-04. By F. E. Nobbs and W. T. Berger. The Westminster Press (Gerrards, Ltd.). 4s. net.

Laboratory Notes on Practical Metallurgy. By Walter Macfarlane, F.I.C. Longmans, Green and Co. 2s. 6d.

Astronomy without a Telescope. By F. W. Maunder. W. Thacker and Co.

A Short Introduction to the Theory of Electrolytic Dissociation. By J. C. Gregory. Longmans, Green and Co. 1s. 6d.

The Fan, including the Theory and Practice of Centrifugal and Axial Fans. By Charles H. Innes, M.A. The Technical Publishing Co., Ltd. 4s. net.

The Construction of Cranes and other Lifting Machinery. By Edward C. R. Marks. The Technical Publishing Co., Ltd. 3s. 6d. net.

NEW CATALOGUES.

Bulletin No. 9 of the British Electric Engineering Co., Ltd., is devoted to Induction Motors, and contains some excellent full-page half-tone illustration.

Messrs. A. Gallenkamp & Co., Ltd., of 19 and 21, Sun Street, Finsbury Square, E.C., have been appointed sole agents for the Kryptol Gesellschaft, Ltd., of Berlin, for their "Kryptol" Heating Apparatus. We are told that "Kryptol" is a new resistance material for producing heat by electricity. It is partly composed of a mixture of graphite, carborundum, silicates and clay in a granular form. When subjected to an electric current it becomes hot, and is capable of producing any desired temperature up to or exceeding 2,000 deg. C. or 3,600 deg. F. It is claimed that "Kryptol" will endure a temperature of 3,000 deg. C. Price List "K" describes and illustrates some applications of the "Kryptol" Heating Apparatus.

The Sturtevant Engineering Company, Ltd., of 147, Queen Victoria Street, E.C., call attention to their catalogue "The Complete Controller" by means of a folding letter-card giving the contents of the abridged edition. For the convenience of those who desire to write for this catalogue, a detachable order postcard is stapled to the letter-card.

The advantages claimed for the Oliver Typewriter are enumerated in a four-page leaflet issued by the Oliver Typewriter Company, of 75, Queen Victoria Street, E.C.

The "Holmes-Page" Switches are illustrated and described in a catalogue issued by the sole patentees and manufacturers, Messrs. J. H. Holmes and Co., of Newcastle-on-Tyne. The left-hand pages of this catalogue are devoted to descriptions of the different types of switches manufactured by the firm, each of which is illustrated on the opposite page. Recording voltmeters and ammeters are dealt with in a catalogue entitled "Recording Instruments (Patent)."

An illustrated leaflet, describing the Pridmore Automatic Copying press, is issued by the Trading and Manufacturing Company, Ltd., of Temple Bar House, Fleet Street, E.C. It is claimed that the double self-adjusting screw (which constitutes the difference between the Pridmore Press and an ordinary one with a wheel handle), effects rapidity of action with ease of operation, and great pressure at the cost of slight exertion.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, JAN. 13.—Institution of Electrical Engineers (Manchester Students' Section): Meeting in the Municipal School of Technology, 7.30 p.m. Paper by Mr. A. F. Jephson, "Electric Heating."—Tramways and Light Railways Association: Meeting at the Society of Arts; 8 p.m. Paper by Mr. H. M. Sayers, "Overhead Equipment."—Junior Institution of Engineers: Meeting at the Westminster Palace Hotel, 8 p.m. Professor Vivian B. Lewes will lecture on "The Theory of the Incandescent Mantle."—Institution of Civil Engineers (Students' Section): Great George Street, Westminster: 8 p.m. Mr. James Swinburne will lecture on "Theory of Electricity and Magnetism."

SATURDAY, JAN. 14.—Manchester Association of Engineers: Paper by Mr. R. M. Neilson, "A Comparison of Different Types of Steam Turbine."

MONDAY, JAN. 16.—Institution of Electrical Engineers (Newcastle Local Section): Meeting, Durham College of Science.

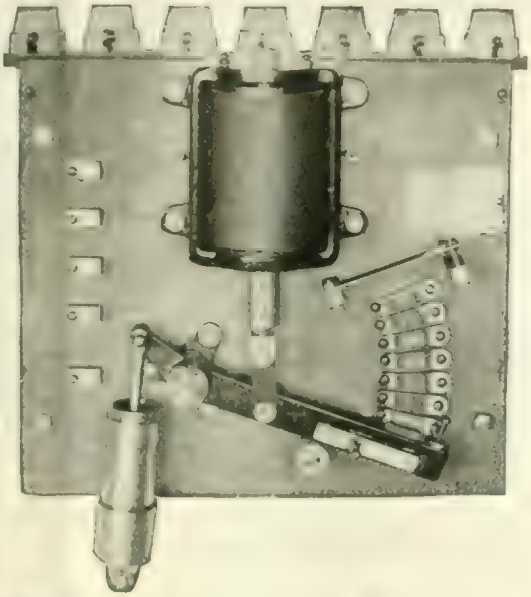
TUESDAY, JAN. 17.—Royal Institution: 5 p.m. Professor Miall's Course. First Lecture.—University of Liverpool Engineering Society: 5.30 p.m. Paper by Mr. Frederick Hughes, "Filtration of Water."—Institution of Electrical Engineers (Manchester Local Section): 8 p.m. Paper by Mr. H. M. Wilson, "Electric Driving in Textile Factories."—Royal Colonial Institute, Whitehall Rooms: 8 p.m.—"Fiscal Preference from an Australian Point of View."

WEDNESDAY, JAN. 18—Institution of Electrical Engineers (Birmingham Local Section): Birmingham University, 8 p.m.—Chemical Society: 5.30 p.m.—Geological Society: 8 p.m.—Society of Arts: Ordinary Meeting.

THURSDAY, JAN. 19.—Royal Society: Burlington House, [illegible] p.m. Professor Churton Collins.—Institution of Electrical Engineers, Leeds Local Section: Yorkshire College, 8 p.m.—Dundee Institution of Engineers: Paper by Mr. David R. Cowpar, "The Marine Engineer; his training duties, and responsibilities."

FRIDAY, JAN. 20—Institution of Mechanical Engineers: Storey's Gate, S.W., 8 p.m.; Papers;—"Some Impressions of American Workshops," by Mr. A. J. Gimson; "Waterworks Pumping Engines in the United States and Canada," by Mr. John Barr; "Some Features in the Design and Construction of American Planing Machines," by Mr. Archibald Kenrick, Jun.; "Engines at the Power Stations, and at the St. Louis Exhibiton," by Mr. Alfred Saxon.—Royal Society: Burlington House, W., 9 p.m. Paper by Sir J. Dewar, "New Low Temperature Phenomena".—North-East Coast Institution of Engineers and Shipbuilders, Newcastle: Paper by Mr. J. Little, "Petrol Motor Cars",—Electric Harmonic Smoker: Holborn Restaurant, 8 p.m.

PAGE'S WEEKLY Miscellaneous



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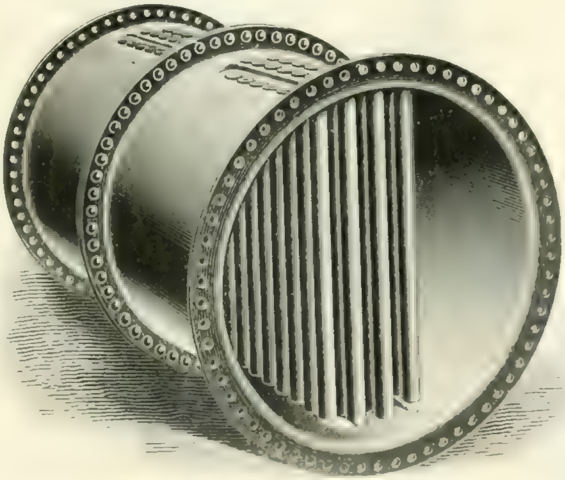

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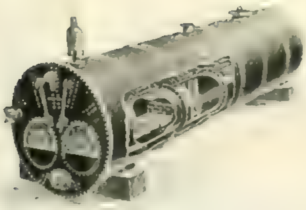

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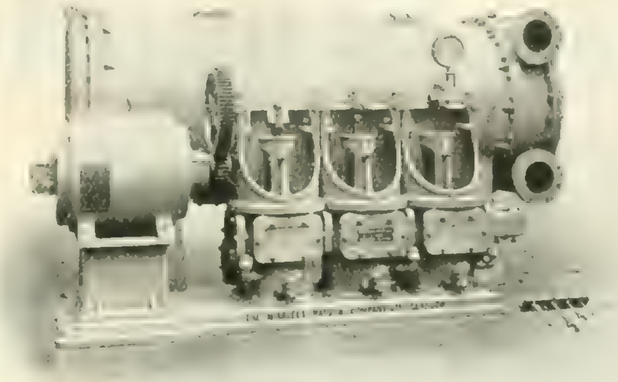

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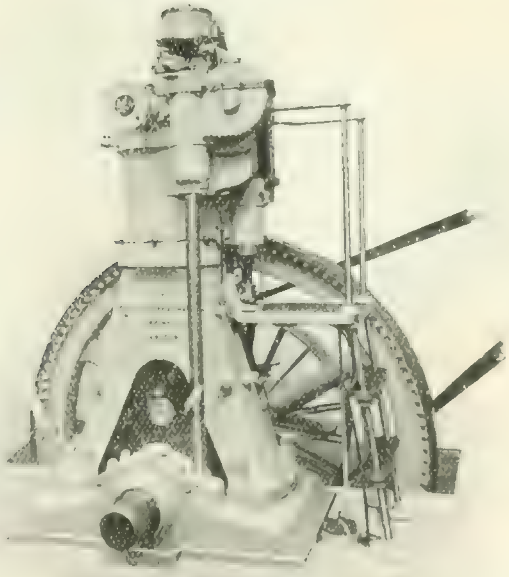

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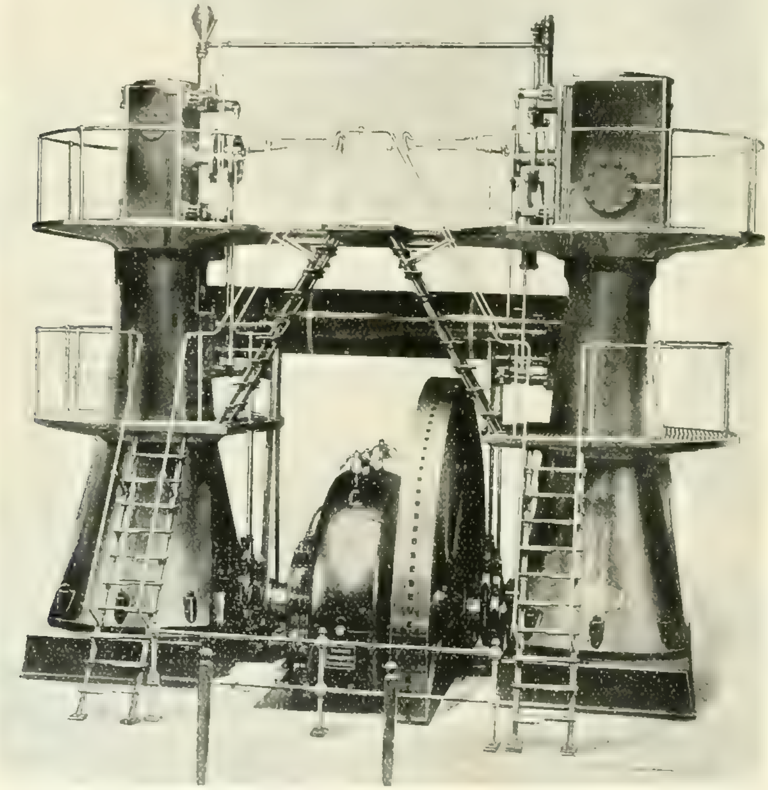

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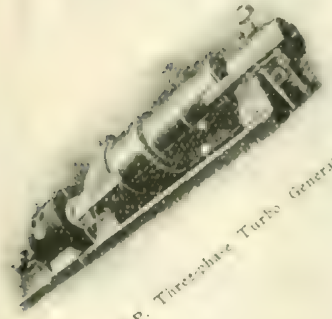

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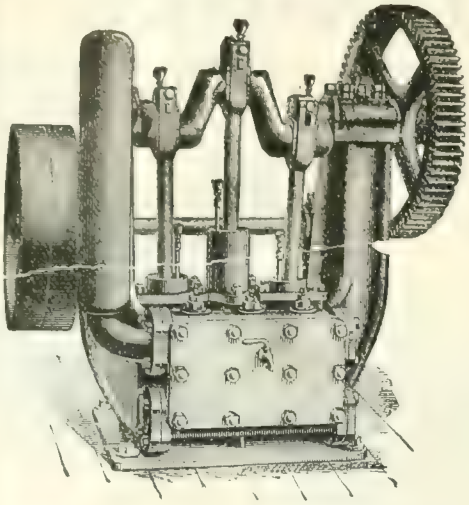

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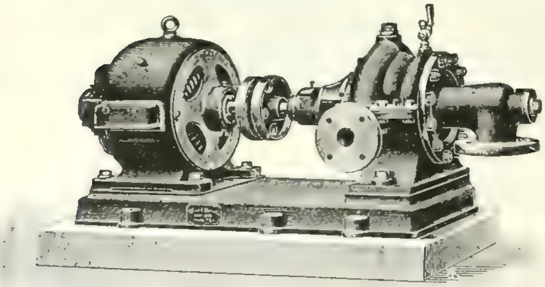

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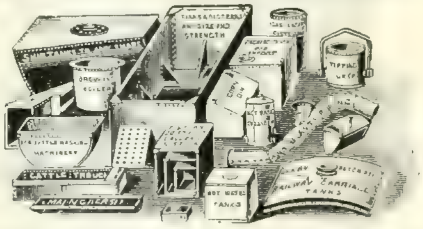

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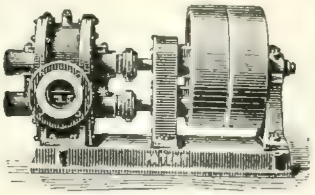

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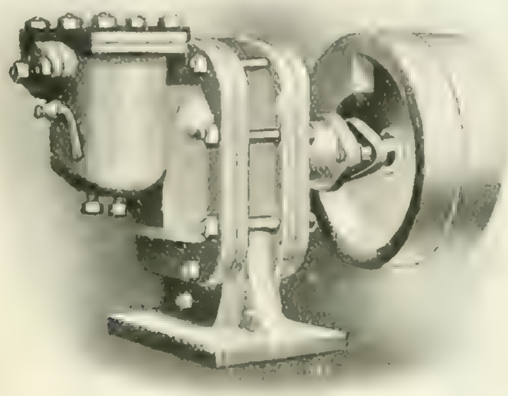

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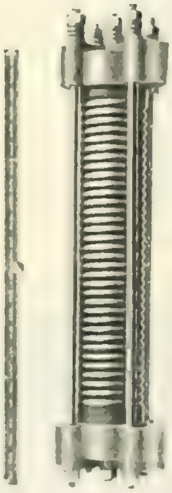

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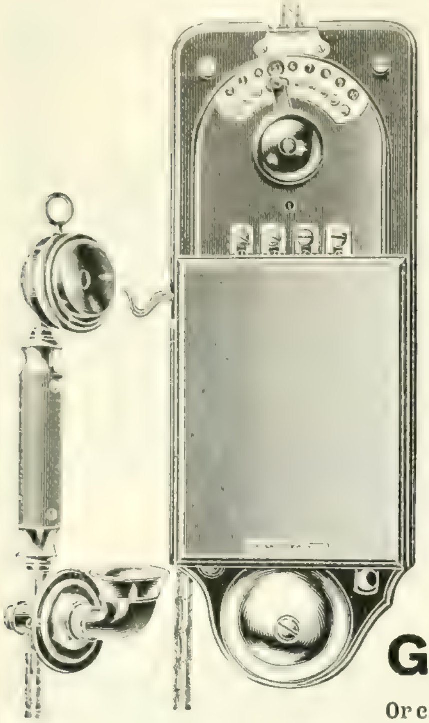

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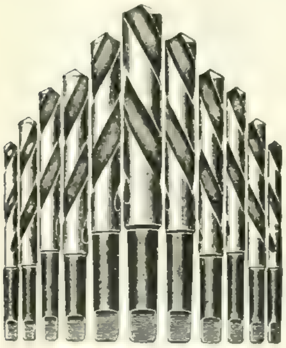

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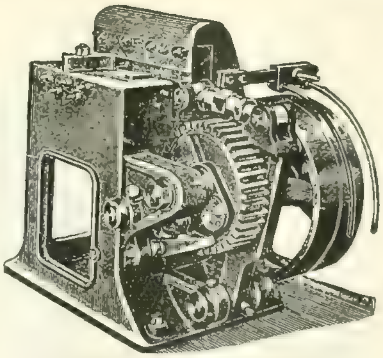

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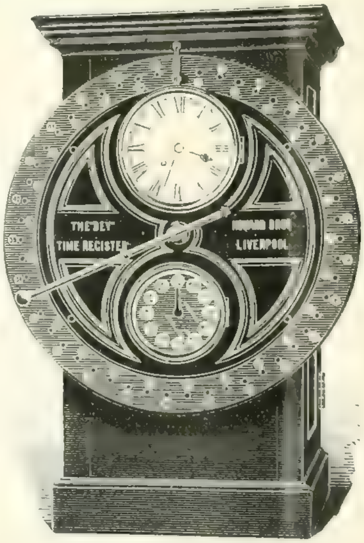

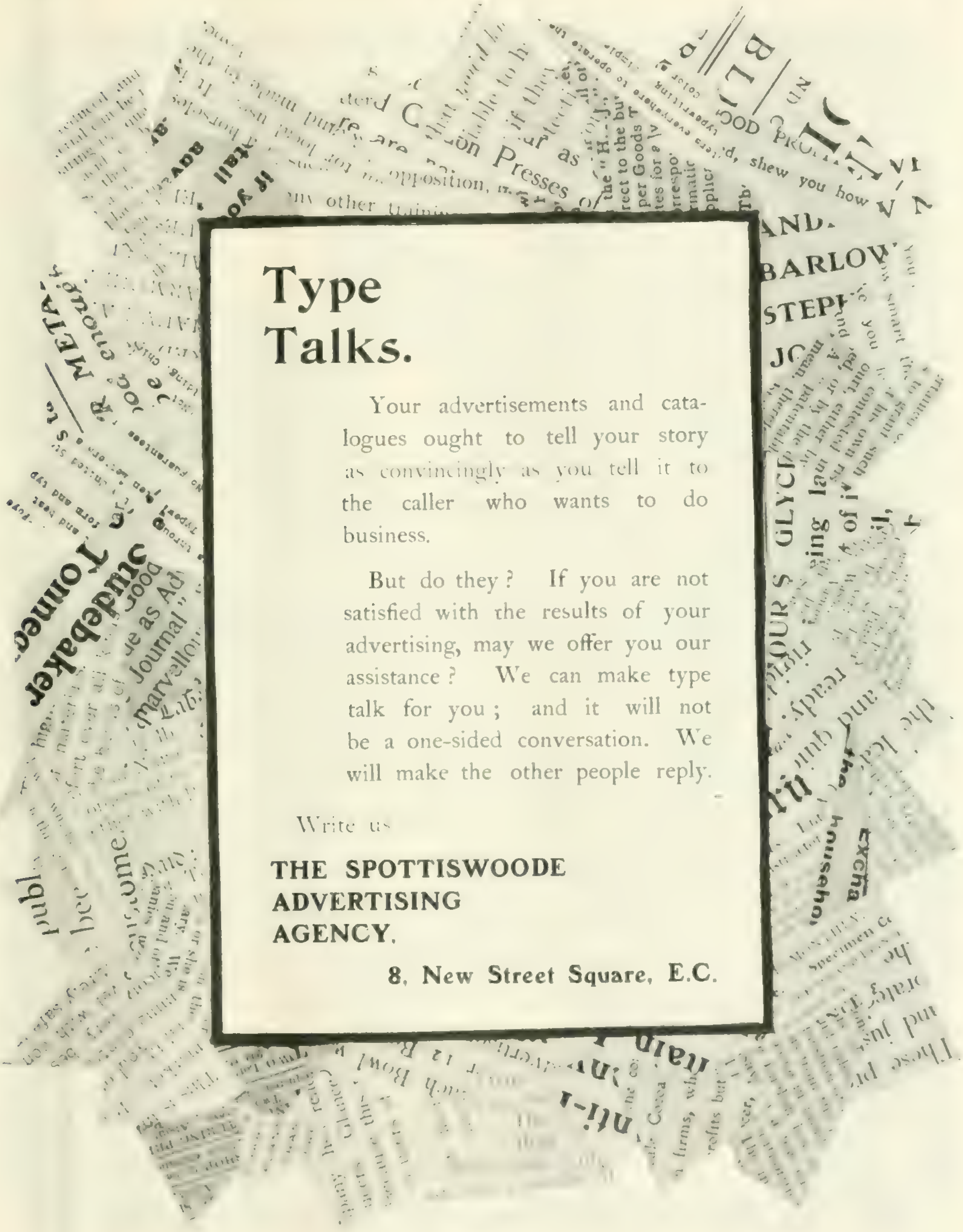

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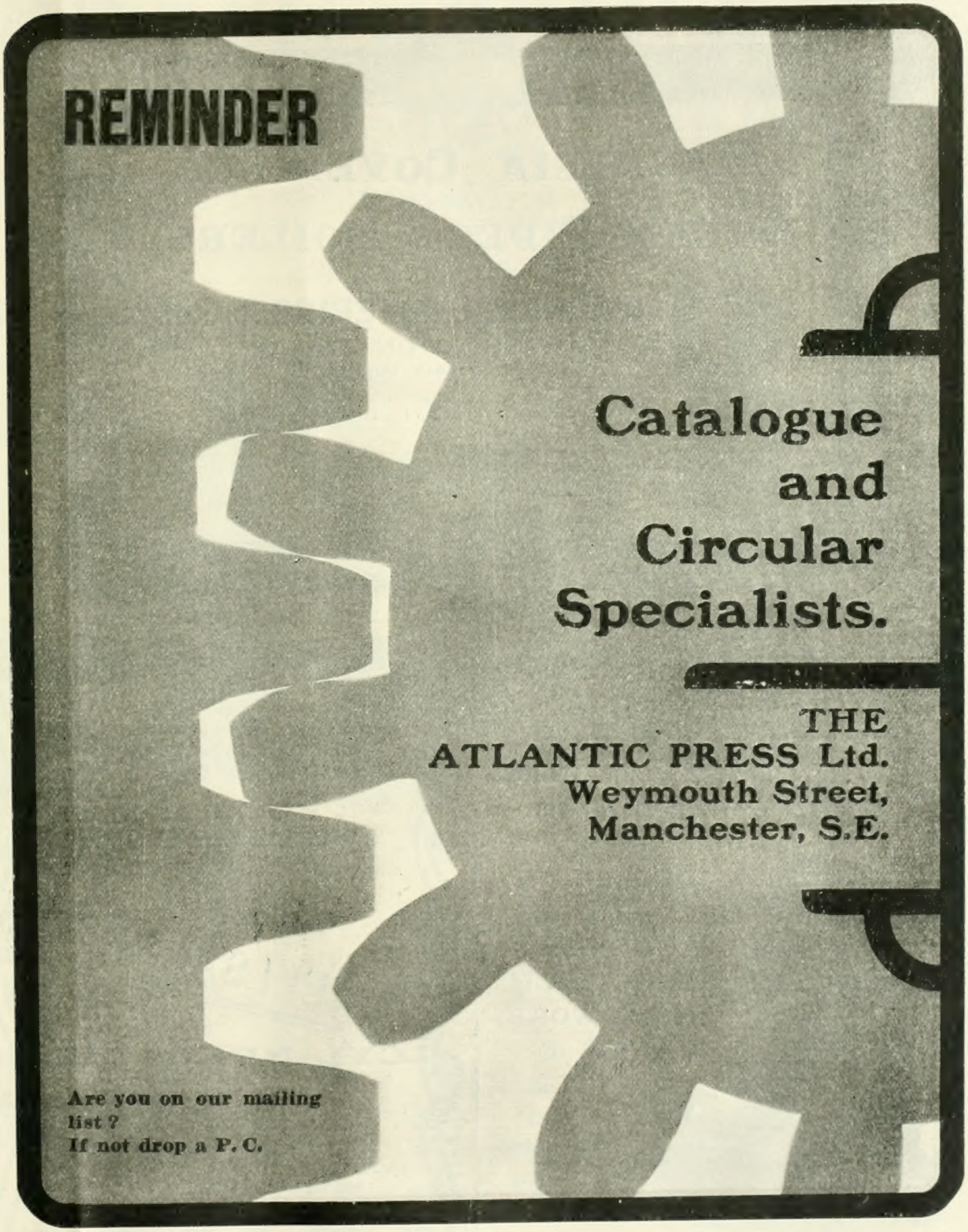

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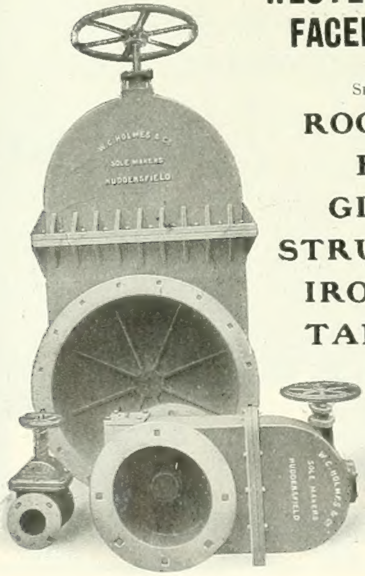

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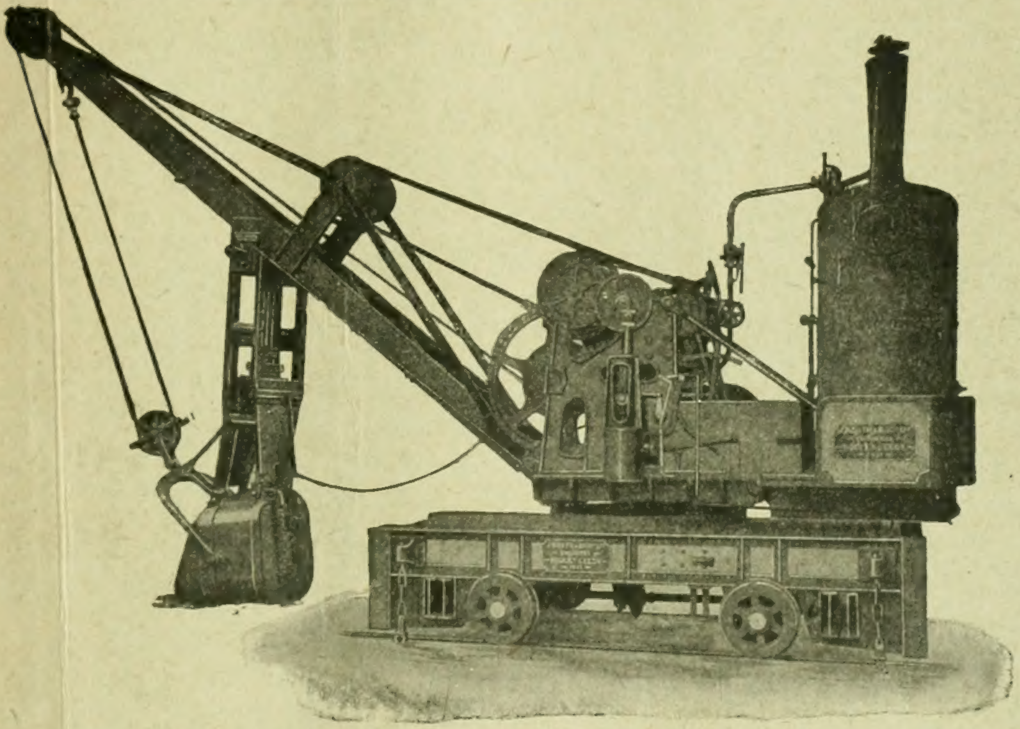

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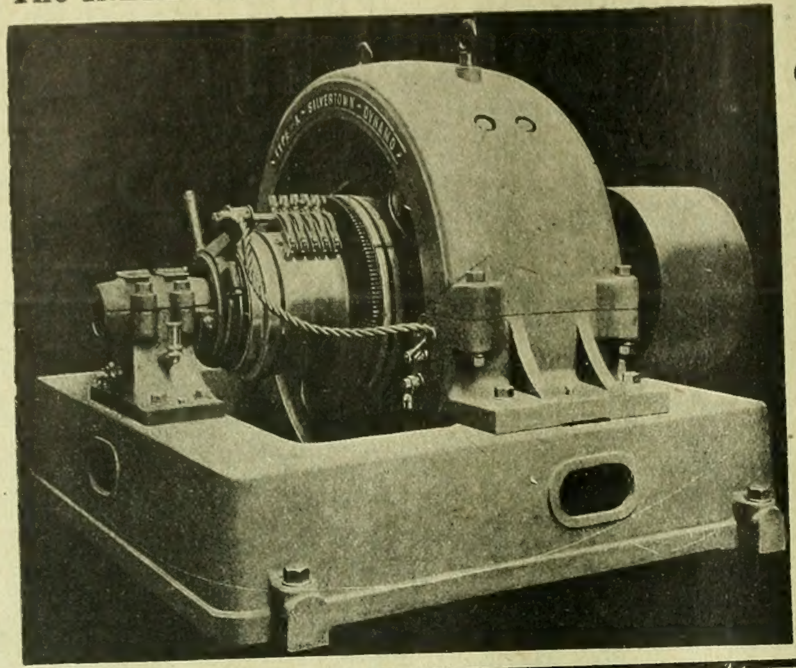

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